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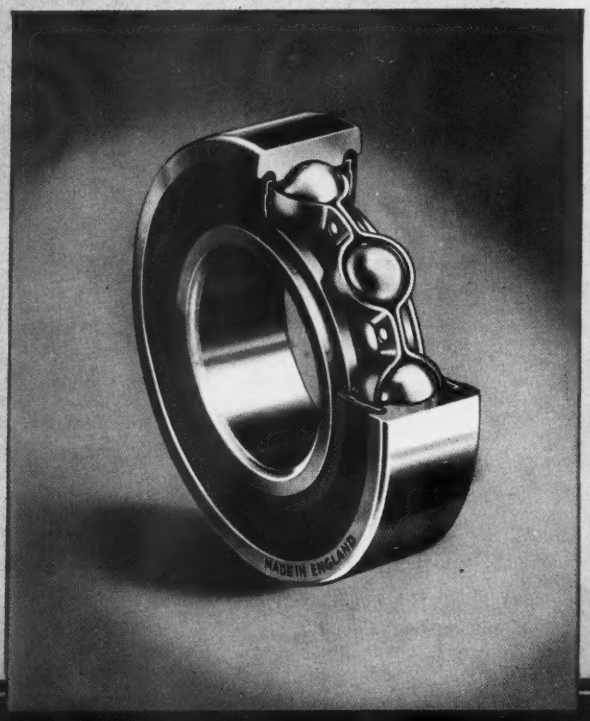

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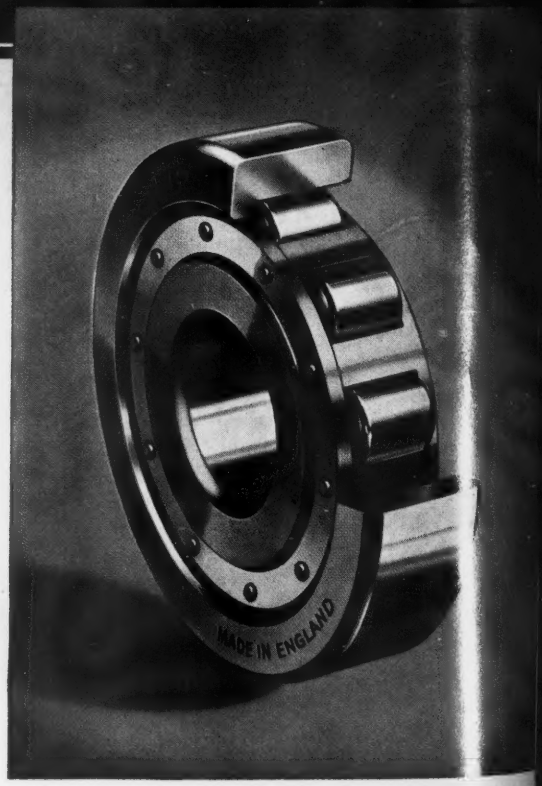

ELECTRICAL REVIEW

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3 FEBRUARY 1956

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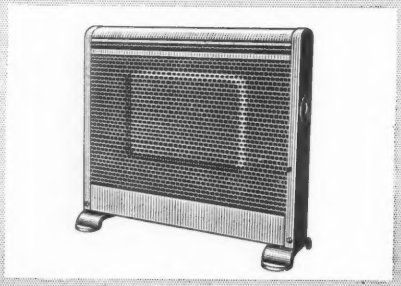

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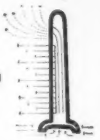

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ELECTRICAL REVIEW

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Specialized Lighting

THE article in this issue on "Lighting in Oil Refineries" by Mr. S. E. Harris has evoked some thoughts on the subject of specialized lighting. We use this term mainly in the sense of the development and provision of special equipment to meet the requirements of protection against explosion which might result from a gaseous atmosphere in which the equipment is used being ignited by an arc in an electric circuit or by contact with the incandescent filament of an electric lamp. Specialized lighting in another sense, of course, is the treatment of various surfaces to be illuminated by different forms of lighting and lighting equipment, and it is remarkable how great the development has been in this sense despite the restrictive effect on lighting efficiency of safety considerations.

The development of especially safe lighting equipment started, of course, with the use of electrical equipment in gassy coal mines. As we have already pointed out, right from the early days of this century when research was started into producing flameproof enclosures, including those for lighting fittings, the safety requirements have all along placed a certain restriction on the use of electricity in coal mines, but in spite of that to-day the National Coal Board is equipping all new and reconstructed mines practically wholly electrically. In view of these necessary safety restrictions, expressed as special designs, the establishment of the use of electricity at the coal face and in oil refineries and certain chemical works has advanced in an extraordinary way.

Generally flameproof requirements in the oil refinery are similar to those in the coal mine, although Mr. Harris points to certain marked differences in special cases. For instance he says that the term "weatherproof and flameproof" has come to be accepted in specifications for lighting equipment to be used outdoors in dangerous areas in refineries, for exposure to the weather can, without special provision, destroy the protection afforded against explosion hazards. Again, Mr. Harris mentions that so far a flameproof fitting considered to give satisfactory protection when used in the No. 4 group of gases and vapour (hydrogen) has not been produced, and he points to such methods as the use of armour-plate glass in the roof and the pressurizing of the air inside flameproof fittings as ways of getting round this problem. We think that in the light of research already carried out in the electrical world such methods are somewhat clumsy and we certainly do not despair of a satisfactory flameproof fitting being produced for use in the No. 4 group of gases. We have much the same ideas in respect of the air pressurizing of control rooms to which Mr. Harris also refers.

EXPORTS STILL RISING

Without the influence of the credit squeeze, increased purchase tax or hire-purchase restrictions, which are only now having their full effects, exports of electrical equipment from this country in 1955 rose to a new record level. The Board of Trade returns for December show that a total of £191·9 million was reached last year in the "electrical machinery, apparatus and appliances" section; the previous highest figure was £183·2 million in 1952. In addition to this there are many electrical items in other sections of the returns as we show in our analysis on another page of this issue. Again the statistics show the value to this country of Commonwealth markets and particularly of Canada whose share showed a substantial rise (as did that of New Zealand). Australia and South Africa still headed the list of customers although last year their order was reversed. Notable features of electrical export trade were the revival of cable exports and the satisfactory increase in smaller equipment, including domestic appliances.

METHOD IN POWER STATIONS

Organization and method (O. & M.) studies are a common feature in modern industry and they have led to much improved working in very many cases. O. & M. is a way of doing things so that labour is saved and duplication of effort is avoided. It enables workers to produce as much or more with less expenditure of effort and at lower cost. So far the system has been applied principally in factories and offices; now it is proposed to employ it in the electricity supply industry, initially in power stations. There seems to be no reason why the application of method in this sphere should not be as successful as it has been in manufacturing establishments. With continually rising costs, coupled with the obligation thrust on the Central Electricity Authority to increase its surplus for capital purposes, anything likely to lower the cost of generation is worth trying.

USEFUL COLLABORATION

Of the various suggestions made for securing collaboration between the two great secondary fuel services, the most practicable appears to be a more extensive use of electricity in gas works. From the particulars given by Mr. L. J. Clark in his Institute of Fuel paper of the practices of the North Thames Gas Board, it can be deduced that fuller electrification still is contemplated, not only on grounds of cost but also of money-saving convenience. Another form of collaboration is to be found in increased running in parallel of the larger electricity generating sets of the Gas Board with the system of the Area Electricity Board.

SANDWICH COURSES

In a paper in a symposium under the above heading presented to the Institution of Mechanical Engineers on 27th January, Mr. D. A. Wraugham, M.Sc.(Eng.), Wh.Sc., points out that the great demand for technologists has created such an expansion in universities and technical colleges that the provision of places now exceeds the supply of suitable students, and were it not for students from overseas there would be unfilled places in engineering courses. This state of affairs coincides with an acute shortage of staff; so to provide specialized courses merely because such courses exist elsewhere, is to act extravagantly and contrary to the best interests of the country. Under the ægis of the Regional Advisory Council, the needs of industrialists should be considered in relation to existing provisions, the possibility of recruiting the right types of staff and apprentice, and the prospect of the right type of employment when trained. In diploma courses at Sunderland, the task is to train, *inter alia*, engineers, and, since a teacher cannot impart knowledge which he does not possess nor a leader inspire qualities in which he is lacking, it is desirable that teachers shall have first-hand experience of the work on which students will be ultimately engaged.

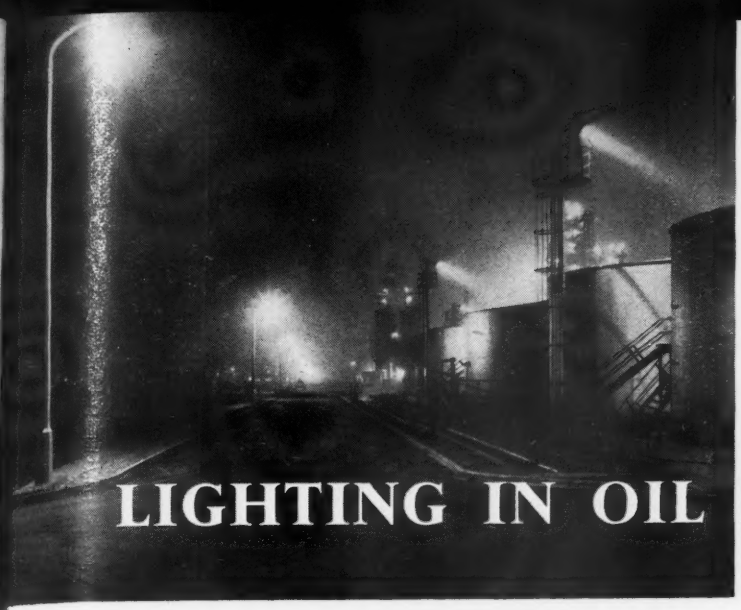
LIGHTING AND PLANT GROWTH

Success in the use of supplementary lighting to control plant growth is referred to in the United Nations report on rural electrification in Europe, which is summarized in this issue. The results achieved are, however, somewhat empirical and more knowledge is required of their scientific basis, about which opinions differ. In Western Germany, for instance, reddish light (2,900 deg K) is preferred, whereas in Scandinavia the choice is white light (above 3,500 deg K). The suggestion is that in the more northerly latitudes the low altitude of the sun results in a greater emission of red rays, since the ultra-violet rays are more easily filtered out by dust and mist.

HEAVY-WATER REACTORS

The abandoning on economic grounds, as reported in *The Times*, of the joint British—New Zealand distillation scheme for the production at the Wairakei geothermal region of heavy water as well as electricity does not appear to be very serious. It is not likely to delay the setting to work of those of the new research reactors at Harwell (reported in our last issue) that depend on the use of deuterium. Supplies available from Norway are said to cost £75,000 a ton, against a preliminary estimate of about £45,000 from New Zealand. Unfortunately further investigation suggests the last figure may be doubled. More recently surplus heavy water has been offered by the U.S.A. at about £23,000 a ton, but the period seems indefinite and it would cost dollars. Heavy water, which gives a high neutron flux density, is required in smaller quantities for reactor research, testing materials and certain radio-isotopes.

Temporary production difficulties have arisen through a dispute in the printing industry. We therefore ask our readers' indulgence for any deficiencies in this week's *Electrical Review*, which have been unavoidable.



LIGHTING IN OIL REFINERIES

SURVEY OF REQUIREMENTS IN THE VARIOUS LIGHTING FIELDS IN THE REFINERY

By S. E. Harris*

THE enormous growth in the importance of oil in world economic affairs in the last two decades is due to the rapid increase in consumption—high octane spirit for conventional aircraft, petroleum for motor cars, kerosene for jet engines, diesel oil for locomotives, and fuel oil for industry. In consequence of this vast development the production of crude oil from existing and new wells is constantly increasing and combined with the political events of the last few years it has resulted in considerable expansion in refinery capacity all over the world. In this country alone refinery output rose from 9,284,000 tons in 1950 to 28,078,000 tons in 1954 as a result of the construction of a number of completely new refineries and major extensions to existing plants.

Owing to the hazardous nature of the processes the electrical installations in these refineries, and the lighting systems in particular, require very careful treatment involving the use of specialized equipment, designed to operate safely without risk of explosion whatever electrical fault may develop. Inflammable gases and vapours are divided into four groups, according to the permissible gaps between the flanges of flameproof fittings, which are designed to comply with the requirements of the Ministry of Fuel and Power (Mines Department). Buxton certificates are given for groups 1 to 3 but group 4 covers excluded gases such as hydrogen, and the maximum safe gap is too small to be practicable. In consequence, no flameproof fittings have so far been approved for this category.

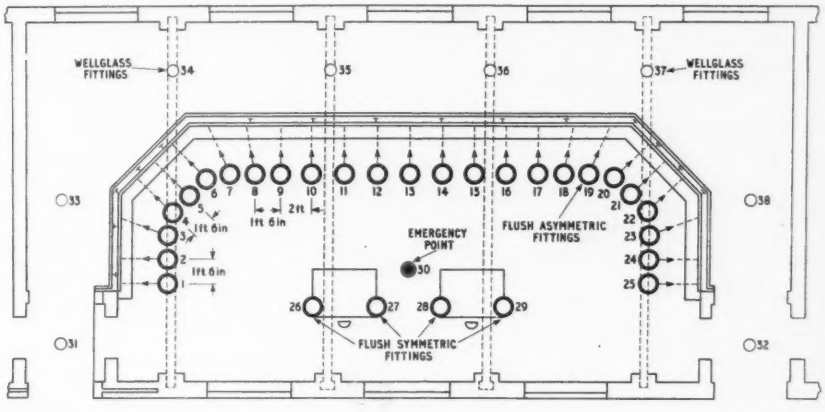
The construction of certified fittings must be such that they are capable of withstanding an internal explosion without fracture of metal casting or glass. The widths of the flanges of the detachable portions of these fittings, as well as the maximum gaps between the flanges, are rigidly specified to ensure the quenching of a flame from any internal explosion. In other words it must be impossible for any external explosion to be caused by any fault within a flameproof lighting unit. The principal hazard in an oil refinery is, of course, petroleum gas which comes within group 2, but some newly developed processes may involve hydrogen in group 4.

An additional feature in flameproof fitting design is the provision of a barrier between the lamp and the main wiring connection which necessitates a separate wiring chamber. The terminals within this chamber must be carefully designed to avoid risk of electrical breakdown due to condensation, as many of the lighting fittings in a refinery are installed in exposed positions and condensation can present a very serious problem. For this reason conduit is not normally employed, at least in external plants, and wire armoured cables or mineral insulated cables are generally used in conjunction with suitable compression type glands for entry into the lighting fitting.

The Institute of Petroleum in its Electrical Code gives guidance to the oil industry in the United Kingdom regarding the classification of a refinery into "dangerous" and "safe" areas, and recommends distances from a danger area of 50ft measured horizontally, or 25ft measured vertically, which can be assumed safe. These are minimum recommendations affecting the use of flameproof equipment

* Mr. Harris is with Holophane, Ltd.

Title picture shows flameproof street lighting and floodlighting at the Grangemouth Refinery



Layout of typical oil refinery control room showing disposition of flameproof lighting fittings. Flush mounted fittings numbered 1–25 provide asymmetric light distributions (arrows indicating direction of light from each fitting) and 26–29 have symmetric light distributions. Wellglass fittings are numbered 31–38

and result in considerable varieties in the standards adopted by the different oil companies. Some managements accept the minimum distances specified while others prefer to adopt a higher factor of safety and classify the whole of a plant area as hazardous. In such cases, flameproof lighting is provided for roadways and open areas, and stores, offices and even lavatories within this area are also provided with flameproof fittings. In other refineries the use of certified flameproof equipment is confined to the actual plant and normal road lighting is then employed. Plant control rooms in most cases are flameproof, but others which are pressurized are lighted by vapour-proof fittings.

A modern oil refinery is very extensive and may cover an area of 800 to 1,000 acres, but for lighting considerations it can be divided into three main sections, the refining plant, the utilities (power, steam and water) and tankage (storage). Owing to its complex nature, the refining plant requires the greatest number of individual lighting fittings, and in the United Kingdom these must all be of the certified flameproof type. The refining plant is subdivided into a number of different units, each producing its own particular product either direct from crude oil or from a subsequent derivative. The products range from gases such as methane, propane, and butane to aviation spirit, and on to diesel and fuel oils. Each unit has certain common features such as the control room and pump house, and from a lighting point of view the control room is probably the most important area on the whole site.

Control Room Lighting

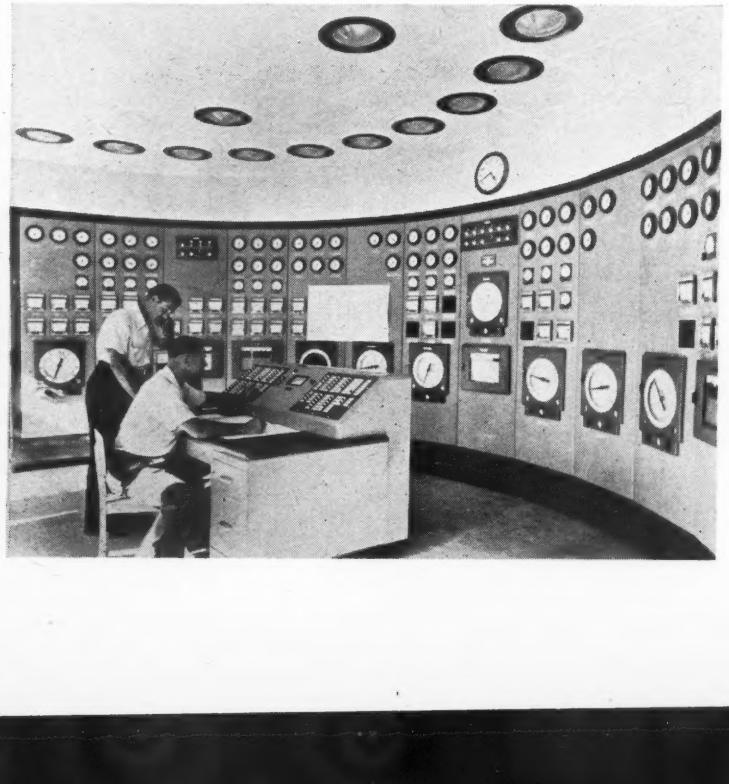
Here is the nerve centre of every unit, manned twenty-four hours a day, and usually relying entirely upon artificial light which must be of a very high standard to ensure operation at maximum efficiency. The important factors are an evenly distributed illumination, without glare, particularly on the vertical boards, and sufficiently high intensity lighting to enable the many instruments to be read without difficulty or discomfort. Modern control panels normally have a relatively good reflection factor and a finish which gives brightness without glare. Black is seldom used to-day and the most popular colour is a medium shade of green which is very restful under conditions of prolonged scrutiny. Thus too great a contrast with the usual white background of the instrument dials is avoided, although they still remain the brightest objects in the field of view.

Good vertical lighting on the control panels, however, is not sufficient to provide good seeing conditions, and in designing a lighting scheme for a control room it is necessary to relate the brightness values of the surroundings to the brightness of the panels. Suitably lighter decorations are used for walls and ceilings to offset to some degree the smaller component of light received directly from lighting fittings, which are primarily intended to illuminate the panels. Further, glare from reflections from the glass fronts of the meters and instruments must be avoided. This is achieved by placing the lighting fittings so that their images, which are reflected by the glass fronts, are directed away from the normal angle of view.

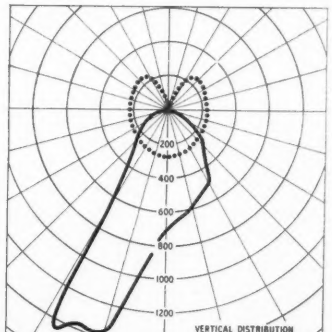
In most control rooms a false ceiling is provided at a height of approximately 2ft above the top of the panels, enabling a system of recessed lighting to be installed. A most effective method is to use flameproof fittings equipped with special asymmetric lenses recessed above circular apertures cut into the ceiling. This provides a very neat arrangement, and the asymmetric lens is designed to project the main beam of light towards the lower portion of the panel, compensating for the greater distance the light has to travel from the fitting and oblique angle of incidence, and ensuring even illumination from top to bottom.

With a suitable spacing of fittings along the front of the panel a relatively even illumination over the whole of its area is obtained. In a typical control room, in order to provide an average illumination of 20 lumens/sq ft over the board area, it is necessary to arrange for 200 W recessed asymmetric flameproof units to be mounted at approximately 2ft centres at a distance of 3ft from the board. Supplementary fittings with symmetric lenses are provided for general illumination and for localized lighting of the control desk which is usually situated in the centre of the room. Here again the object is to provide a comparable level of illumination over the horizontal working area. Localized lighting is also provided at the rear of the boards by means of flameproof fittings having a wide angle light distribution.

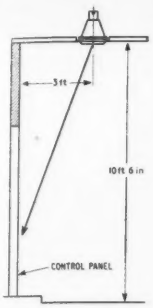
It is the custom of some oil companies in designing their refineries to make provision for pressurizing control rooms by taking in air, presumed free of contamination, from an



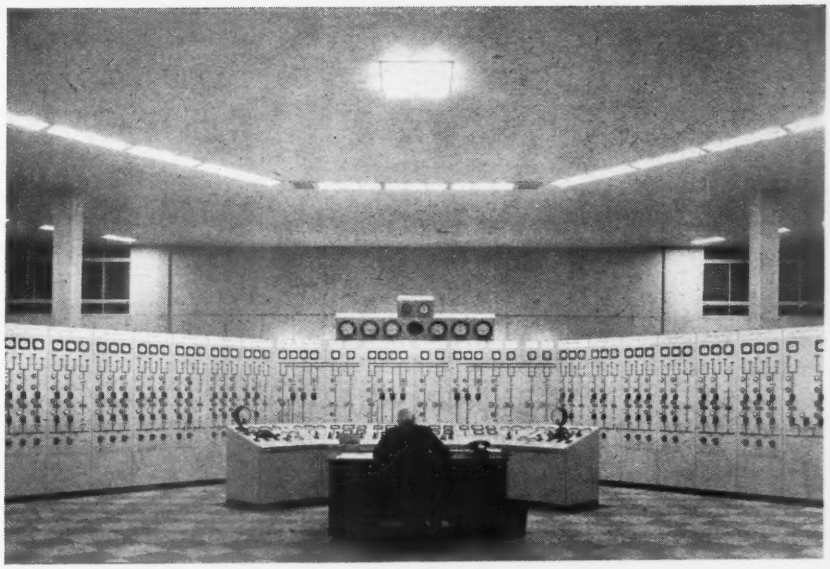
Kwinana Refinery, Western Australia; main control room, distillation plant



Typical polar curve showing light distribution from an asymmetric control room lighting fitting



Above: Section indicating relative position of flameproof fitting recessed in ceiling of control room. The prismatic refractor provides asymmetric light distribution on to the vertical surface of the control panel



Right: Llandarcy Refinery; power station control room

inlet more than 25ft above the ground, and in these cases it is not considered necessary to provide certified flameproof lighting units. The procedure in many such cases is to provide either recessed or surface type vapour-proof units, equipped with prismatic lenses which, by offsetting the interior lamp and reflector, produce asymmetric angled light distribution similar to that given by the special flameproof units already described. Fluorescent lighting has been used in some instances, and while it is possible to obtain a glare-free illumination by this means lighting control and intensity are not so readily obtained as with the greater number of tungsten lamps which can be accommodated along the front of the panel.

General Plant Areas

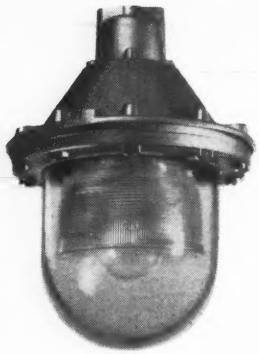
The majority of the pump houses are fairly lofty buildings and present little difficulty for lighting as efficient flameproof pendants incorporating a good type of reflector can be mounted at a reasonable height, and at a spacing which ensures adequate and even distribution over the whole area. Usually, 200 W fittings are suitable for this purpose, but where height and other conditions permit it is sometimes an advantage to use 300 W fittings. The level of illumination necessary in these buildings is not so high, as the work is of a relatively casual nature, and some 6 to 8 lumens/sq ft is usually considered sufficient.

A large proportion of the lighting fittings throughout the plant area is for the illumination of stairways, gangways, and platforms, and small lighting units equipped with 100 to 150 W lamps are employed at positions carefully chosen to avoid shadows. These are usually of the well-glass type, giving a wide distribution at comparatively low mounting heights, so that when mounted close to the underside of the platform above they ensure good vertical illumination to cover valves which themselves may be nearly as high as the lighting fitting. For the lighting of the upper platforms and open stairways it is usual in each case to mount a fitting on a tubular standard and bracket at a height of about 8ft. At night the many hundreds of illuminated fittings, covering every section of the plant, are somewhat reminiscent of the effect striven for by popular seaside resorts during late summer and autumn.

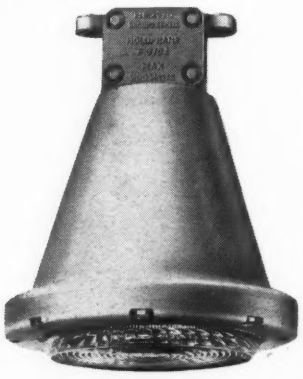
Many of these fittings are exposed to the weather, and apart from the need to take precautions in the design of the terminals, to avoid the consequences of condensation the flanges of the lighting units must be adequately protected against the weather. On occasion flameproof fittings have been found partly to fill with water within a short period when used in some exposed position on the plant. Because of the special requirements of oil refinery lighting at these exposed plants the design of flameproof fittings has undergone a change in recent years and the term " weatherproof and flameproof " has come to be accepted in specifications for this type of work.

In certain of the process buildings, such as in a dewaxing plant, some vessels are provided with inspection ports for visual examination at periodic intervals of the liquid inside, and consequently it is necessary to provide sufficient light inside the vessel for this purpose. This is achieved by the provision of flameproof fittings equipped with concentrating reflectors projecting light through glass panels, generally adjacent to the inspection ports, in such a way that there is no glare to the observer. Other applications for lighting within the plant are for localized purposes and, for example, small flameproof bulkhead fittings may be used for the illumination of gauge glasses and individual instruments.

Reference has been made to the use of hydrogen in one of the newer refinery processes, and as this gas is in the group 4 category, for which no certified flameproof fittings are made, special arrangements are necessary. Two methods have been employed. One concerns the use of group 2 flameproof fittings mounted in the open air, above armour plate glass panels in the roof of the building, the light being projected downwards through this glass into the interior below. An exterior catwalk alongside the roof glazing is provided for access and maintenance purposes, and specially adapted flameproof fittings, provided with a stirrup and baseplate as in a floodlight, are fixed to the handrail on the catwalk, providing easy adjustment to give the maximum lighting effect. The chief disadvantage of this method is that because of the much greater mounting height the efficiency is lower than with a normal interior lighting system, and furthermore there is absorption in the roof glazing which can become serious if the glass is neglected and allowed to become dirty. The second method employs a normal interior flameproof lighting arrangement with air pressure within the fittings to prevent the ingress of hazardous gas. While this is more efficient



Left: Flameproof lantern designed for road lighting in atmosphere of groups 2 and 3 explosive gases; a prismatic refractor provides symmetric or asymmetric light distribution as required; the housing is of silicon-aluminium alloy casting (300 W)



Right: Flameproof pendant fitting developed primarily for the asymmetric lighting of control panels in oil refineries

from a lighting point of view, air pressurizing is a costly and complicated system involving the use of pressure switches and alarms, in case of air failure, and has not proved generally acceptable.

Open areas, with their variety of pipes and valves and vessels, are usually illuminated by enclosed 500 W and 1,000 W heavy duty floodlights mounted in groups on columns up to 50ft high. These poles are often provided with a vertical enclosed cat ladder and a platform at the top to facilitate access to the floodlights for cleaning and re-lamping. For a more economical arrangement for localized use, to cover isolated groups of valves, flameproof floodlights of 150 W or 200 W capacity are sometimes mounted on adjacent steelwork and angled towards the area to be lighted. These flameproof floodlights are certified for use within prescribed angles from the vertical, and it is important to note that Buxton certificates for ordinary flameproof fittings are based on the assumption that they are used in the normal pendant position. Departure from this procedure may produce a temperature rise over some part of the fitting in excess of the maximum permitted, thus invalidating the certificate.

Not the least important of external lighting is that for access roadways. These are usually extensive, and while in some refineries orthodox non-flameproof street lanterns are used on 15 to 25ft columns according to the use and importance of the roadway concerned, in many others flameproof fittings are installed. These are specially designed to conform to all flameproof requirements and to give a street lighting type of distribution. They incorporate prismatic refractors giving a peak candlepower at angles between 75 deg and 80 deg, usually in two non-axial beams directed up and down the roadway to give good road brightness, as in accepted street lighting practice, and are usually installed at spacings up to 150ft apart or more.

The tank farm (storage) areas are usually lighted by heavy duty enclosed floodlights of 500 W and 1,000 W capacity mounted on suitably disposed poles from 30ft to 50ft high, similar to those used for open areas in the refinery plant. In some cases where the area is not generally lighted in this manner more localized lighting fittings are installed on the access stairways and platforms on the tops of the tanks. The usual arrangement is to provide tubular standards and brackets as on the main plant, and to use a flameproof well-glass fitting to give a wide light distribution to ensure adequate vertical illumination for the reading of dip (measuring) sticks. Tank farms lighted in this way obviously require many more lighting fittings, with a consequent increase in cost of maintenance, and the choice between the two systems may well be resolved on economic grounds, but will also depend upon the type and disposition of the tanks concerned. Adjoining the tankage area are the jetties where modern tankers, now often exceeding 30,000 tons, discharge their cargoes of crude oil during day and night. At night good illumination is of the utmost importance and here refractor type flameproof fittings, as used for roadway lighting, provide the best results for the approaches, with supplementary 500 W floodlighting projected from steel gantries into the holds of the ships.

Having dealt with the areas over which flameproof lighting is generally considered to be essential, reference should now be made to what can be called the utilities area, which includes steam plant, the power station and water supply plant. The first provides by means of oil-fired boilers the steam required for process work and for driving the turbo-generators. As in the refinery plant, the lighting consists mainly of large numbers of small units localized in the gangways, platforms and stairs of the boiler house, with good general lighting from angled projectors in the actual firing aisle. In view of the restricted headroom and the need for fittings to be enclosed for protective purposes, bulkhead fittings are widely employed. Elsewhere, where the height is adequate, suspended dust-tight and vapour-proof fittings are usually installed so that maintenance can be reduced to the minimum.

Turbine house lighting fittings are usually of the high bay type because of the necessity of mounting at heights of upwards of 25ft to clear the travelling crane, but these may be augmented by angled fittings mounted on the vertical steelwork at the sides of the building. In the control room good vertical illumination on the control boards is essential. Fluorescent and tungsten lighting are used for this purpose, but the latter appears to have some advantage in that it can be more accurately controlled and directed, and may well provide a higher degree of illumination as a greater concentration of lamp lumens can be obtained over a given length of board by the use of closely spaced tungsten lamps. An effective and efficient method well tried in practice is to recess these lamps in an offset position above prismatic lenses mounted flush to the ceiling, in such a way that the light is angled towards the board instead of being projected immediately below and largely wasted. The lighting and other requirements are mainly the same as for the plant control rooms, and reflection factors and colours of control panel, ceiling and walls receive similar consideration.

Other buildings in the utilities area are connected with the supply of water, which is required in considerable quantity for cooling purposes and for steam generation, but the pump houses and other buildings concerned present few problems from the lighting point of view, and illumination usually is by orthodox reflectors.

Because of the continuous nature of the processes, emergency lighting has to be provided throughout the refining plant and utility areas. The usual arrangement is to run a separate supply from a standby generator to lighting fittings installed at all the vital points, using flameproof fittings in the actual hazardous areas. In the event of a supply failure the generator is automatically brought into circuit and the emergency lighting fittings are switched on.

Acknowledgment and thanks are due to the British Petroleum Co., Ltd., for permission to publish the photographs illustrating this article.

New Oil Circuit-Breakers

TEST RESULTS ON THE FIRST DEAD TANK EQUIPMENT

FERGUSON Pailin, Ltd., have added to their range of oil circuit-breakers suitable for use on extra high voltage systems by the introduction of a dead tank oil circuit-breaker, designated type XOPR 60, capable of interrupting and of making fault currents equivalent to 5,000 MVA at 132 kV on a 50 c/s, three-phase system, and suitable for carrying currents of up to 1,200 A. The equipment is believed to be the first British made dead tank oil circuit-breaker capable of this duty.

In the development and testing of this circuit-breaker the design engineers have ensured that it complies with all the relevant clauses of British Standard 116 (1952) and the Central Electricity Authority's specification covering this class of equipment. Further, special attention has been given to ensure satisfactory operation under extremes of climatic conditions.

The performance of this circuit-breaker has been proved by a comprehensive series of tests, including those called for in British Standard 116 (1952), carried out at the Trafford Park testing station of the Switchgear Testing Company who, on the basis of these tests, have issued an A.S.T.A. certificate approving the rating assigned to the oil circuit-breaker. Tables I to IV give the results of some of the short circuit tests made on this circuit-breaker to prove the rating of 5,000 MVA. Before carrying out the tests required for the granting of an A.S.T.A. certificate, a considerable number of investigational and research tests were carried out, including some to confirm the suitability of the breaker for switching capacitive and inductive currents associated with line charging and transformer switching, respectively.

In construction the complete three-phase circuit-breaker consists essentially of three separate single-phase units, the individual mechanisms of which are linked externally, through light alloy drives, to a common operating mechanism arranged for power closing. A weatherproof kiosk of ample proportions houses the power operated closing mechanism, local control apparatus, secondary wiring, multi-core cable terminations, etc., and is mounted at a convenient height on the front tank of the three-phase breaker.

The power operated closing mechanism is trip free throughout the

TABLE I.—Break Tests on Complete Circuit-Breaker

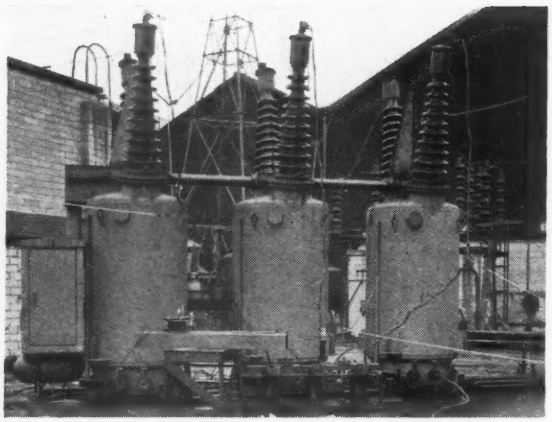
Duty	Operation & time interval	Applied voltage, kV	Breaking current Sym., kA	Breaking current Asym., kA	Recovery voltage, kV	Arc duration, sec x 10^{-2}
5 per cent sym. breaks at 132 kV	B — 3′	144	1.00	1.04	136	1.9
	B — 3′	144	1.01	1.04	138	2.8
	B	144	1.01	1.04	138	2.2
10 per cent sym. breaks at 132 kV	B — 3′	144	2.23	2.26	134	2.9
	B — 3′	144	2.22	2.26	134	2.5
	B	144	2.17	2.22	130	3.0
30 per cent sym. breaks at 132 kV	B — 3′	151	6.39	6.51	134	2.3
	B — 3′	151	6.33	6.39	133	2.5
	B	151	6.39	6.51	132	2.2
60 per cent sym. breaks at 77 kV	B — 3′	89.6	12.4	12.6	78.1	1.7
	B — 3′	88	11.7	11.9	76.5	2.0
	B	88	11.9	12.0	76.7	1.8
100 per cent sym. breaks at 44 kV	B — 3′	50.3	22.0	22.2	43.6	0.91
	B — 3′	50.3	22.4	22.8	43.4	1.9
	B	50.3	22.9	23.4	44.3	1.1
100 per cent sym. breaks at 55 kV	B — 3′	61.6	21.6	28.5	52.4	1.6
	B — 3′	61.6	21.7	29.1	52.1	1.7
	B	61.6	21.3	28.5	53.2	1.6

TABLE II.—Break Tests on Complete Circuit-Breaker

Duty	Operation & time interval	Applied voltage, kV	Making Curr. or Ist major peak	Sym. breaking current, kA	Recovery voltage, kV	Arc duration, sec. x 10^{-2}
100 per cent make and breaks at 55 kV applied.	MB — 3′	54.4	51.0	18.4	45.4	1.4
	M	57.9	64.7	21.5		
30 per cent make and breaks at 132 kV applied	MB — 3′	137	22.4	6.64	103	2.7
	MB	137	17.6	6.64	107	1.8

TABLE III.—Unit Tests (Biermanns)

Duty	Operation and time interval	Applied voltage, kV	Breaking current Sym., kA	Breaking current Asym., kA	Recovery voltage per break kV	Arc duration per break sec. x 10^{-2}
60 per cent Sym. breaks at 57 kV per break	B — 3′	62.3	12.6	12.6	54.8	2.7
			13.0	13.1	53.2	2.1
	B — 3′	62.3	12.6	12.9	53.9	2.0
			13.0	13.1	55.8	2.6
	B	62.3	13.2	13.3	54.8	2.3
			13.1	13.1	54.1	1.8
100 per cent sym. breaks at 57 kV per break	B — 3′	62.5	21.8	22.5	50.8	1.3
			22.0	22.2	51.3	1.9
	B — 3′	63.7	22.3	22.8	49.0	2.3
			21.6	21.8	47.9	1.7
	B	62.5	22.3	23.0	49.0	1.5
			22.0	22.2	49.6	2.0
100 per cent Asym. breaks at 57 kV per break.	B — 3′	61.6	21.2	28.9	49.6	1.9
			22.0	23.2	49.7	1.4
	B — 3′	61.6	21.2	28.9	49.6	1.2
			21.5	22.7	48.8	1.5
	B	61.6	21.2	28.9	48.6	2.0
			22.0	22.9	47.0	2.6



A complete three-phase type XOPR 60 oil circuit-breaker set up for test

closing stroke and can be either of the solenoid or pneumatic type, both designs being similar, with the exception that in the latter case the solenoid assembly is replaced by an air actuated piston coupled to a local air receiver. This receiver is mounted on the underside of the kiosk, and compressed air can be supplied to it either by individual compressors or alternatively, where several units are installed, from one central compressor. If an individual compressor is preferred, this can be mounted on the tank adjacent to the kiosk.

The terminal bushing insulators are of the oil-filled barrier type, each being a self-contained and independently removable unit. Variation in oil volume is provided for by an expansion chamber fitted at the top of the porcelain insulator and a gauge shows the oil level at all times. Adjustable arcing horns are fitted to each terminal bushing. Ample space is provided in the circuit-breaker for bushing type current transformers, these being mounted in turrets through which pass the lower ends of the bushings. An important feature of this design is that the removal of a bushing does not entail disturbance of the current transformers.

TABLE IV.—Through Test

Duty	Applied voltage kV	Making current or 1st major peak	R.M.S. current kA after 0.3 sec.	R.M.S. current kA after 3.0 sec.
Through	7.25	58.1	21.2	23.0

Each fixed contact assembly is of the three segment high pressure spring loaded lever butt type, incorporating a wiping action at the point of engagement with the moving contact, thus ensuring minimum contact resistance. The moving contacts are of tubular form and are mounted in light alloy carrier bars, which in turn are mounted on insulated lifting bars. The lifting bars are connected to the common external operating mechanism via a system of links, while shock absorbing devices provide for the cushioning of the moving members on both opening and closing strokes.

The breaker is fitted with an advanced design of arc control device of the self-compensated cross jet chamber type, resulting in excellent performance over the complete range of current up to maximum fault current. Equal sharing of the duty of current interruption, between the two breaks, is achieved by means of high rated and substantially non-inductive shunt resistors. These resistors ensure that the voltage appearing across each of the breaks is the same. They are also of considerable importance in the limiting of transient over-voltages during switching.

During the opening stroke the moving contacts are accelerated by springs of the torsion bar type which are designed to obtain the optimum breaking speed consistent with reliable and economic closing. The accelerating force provided by these springs together with rapid tripping action, lightness of moving parts and use of short travel butt contacts, ensures a maximum total break time not exceeding three cycles.

Batti-Wallahs' Society

LAST week's luncheon of the Batti-Wallahs' Society was the first in the golden jubilee year of the Society, which was formed on 16th January, 1906, by engineers of the P. & O. Steam Navigation Co. It was appropriate therefore that the guest speaker should be Sir Donald Anderson, deputy chairman of the P. & O. Co. A large attendance of over 100 members and friends was presided over by Mr. G. O. Watson, president of the Society. In introducing the speaker, Mr. Watson briefly referred to the formation of the Society and to the many distinguished men who had been, and were, members. He mentioned particularly the late Col. R. E. Crompton, who was an original member, and the Earl Mountbatten, who is now one of the few honorary members.

Sir Donald, in reviewing the history and progress of the P. & O. Co., said that it had started a museum and suggested that this should include some record of the Batti-Wallahs' Society. He referred to the formation of the Society by Mr. W. Riggs, Mr. E. L. Pinching and Mr. E. Sheppard, and said that its formation by these gentlemen indicated a pride in the company.

Speaking of electrical development on board ship, he referred to the first *Arcadia* built in 1888 which had two generators totalling 20 kW, all of which was used for lighting. The *Arcadia* of to-day had three sets totalling 3,600 kW, and there were 598 motors, 1,162 tungsten lamps, 1,500 fluorescent lamps, and the loading of the equipment in the galley alone was 1,854 kW. Electricity had become the first servant on board ship to-day and there was not a single function which did not depend upon it. Although changes had been made in the company, which was now part of a group which it controlled, the old pride in its ships and in the company still remained, and he felt that despite changes the original Batti-Wallahs would still find that the P. & O. Co. was recognizable.

Mr. J. W. Perkins (past-president) proposed a vote of thanks to Sir Donald in felicitous terms, and suggested that a facsimile of the minutes of the first meeting of the Society would be a suitable contribution to the P. & O. museum.

Mr. T. C. F. Bigland (the "Mate") announced that the next luncheon of the Society would be held on Thursday, 23rd February, and reminded members that the jubilee ladies' night would be held on 16th March.

Faraday Lecture

Mr. B. L. Metcalf is giving the I.E.E. Faraday Lecture in London on 15th February (6 p.m.), at the Central Hall, Westminster. Admission is free by ticket obtainable from the Institution of Electrical Engineers, Savoy Place, London, W.C.2. Applications should be accompanied by a stamped addressed envelope.

Hotel Catering

ELECTRICAL APPLIANCES AT OLYMPIA DISPLAY

THE increasing number of electrical appliances for use in the catering industry is much in evidence at the 1956 Hotel and Catering Exhibition at Olympia, London, which closes to-day (Friday). A very high proportion of the 250 or so stands are devoted to electrical apparatus, emphasis being placed on the need for efficient food service and, what is more important, hygiene.

A fully-equipped electric kitchen suitable for a hotel or restaurant and capable of providing meals for 250 people is the main feature of the British Electrical Development Association's stand where kitchen equipment displayed includes a double-oven range, a stockpot, vegetable boiling pan, sterilizing sink, hotcupboard, fryer, steamer, grill, dishwasher, food mixer, potato peeler, water heater and a hand dryer. Adjacent to the kitchen is a very comprehensive display of ancillary electrical appliances and among items of interest are a single-oven range, two-tier pastry oven, steamer, gravity feed slicer, refrigerator, roasting oven, back-bar unit, 6ft hotcupboard, heated trolley, café set, waterless bain-marie, toaster-griller, waffle maker, coffee machine, high-speed fryer and an incinerator. The back-bar unit referred to is provided with a "lumenated" ceiling demonstrating the special quality of fluorescent lighting.

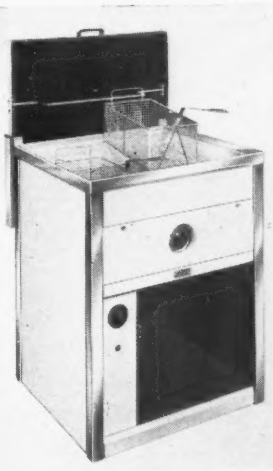
A separate section of the stand is devoted to a display of various types of electric space heaters. Electric water heaters, ranging from 15 to 100 gal capacity, are shown.

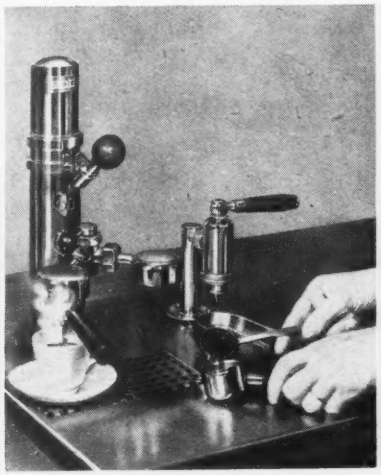
The story of the British European Airways catering unit at London Airport, for which the General Electric Co., Ltd., supplied all the equipment, is told in photographs on this company's stand. Items of aircraft cooking equipment are also shown, in addition to a single-oven range, boiling table, fryer, hotcupboard, stockpot, grill, water boiler, etc. The fryer employs stainless steel immersion type elements and temperature is controlled by a variable thermostat operating through a contactor. Two large-capacity wire baskets take 10-12 lb each per charge or 70 lb of chips an hour. Other G.E.C. exhibits include fans, an 8 cu ft refrigerator, cleaners and floor polishers, lighting fittings, "Nightstor" heaters, tubular heaters and a 100 gal water storage heater.

On the Jackson Electric Stove Co.'s stand is a representative selection of cooking apparatus for both large and small kitchens. A new departure for the company at this exhibition is the unit-constructed snack bar equipment. Two separate boiling and grilling units are on show, one with two radiant plates (8in and 6¼in) and a 10½ by 8in grill boiler with hotcupboard space underneath. An alternative smaller unit is available with one 8in plate and grill boiler. Among other apparatus to be seen on this stand is a single-oven range, steaming oven, a two-tier general purpose roasting oven and hotcupboards for school meals kitchens and industrial canteens.

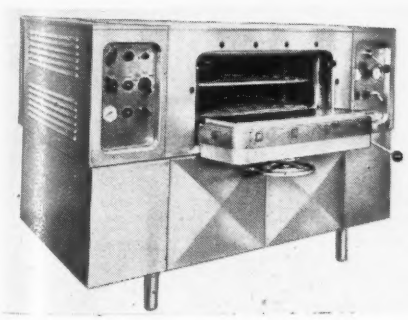
What is claimed to be the greatest advance in large scale cooking within recent years is shown by Kitchen Machines, Ltd. This is the "Ovenator", an electric oven combining infra-red and superheated steam cooking, which has been developed by Swedish engineers. It dispenses with the need for fume extraction hoods and with its use it is claimed that fuel bills are reduced by 25 per cent.

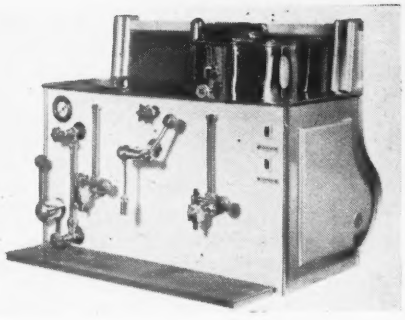
Some interesting new tea and coffee making machines attract attention, including the "Bruin" automatic tea brewer and dispenser shown by Peerless & Ericsson, and the "New Connoisseur" by James Stott & Co. (Engineers),





Above left: G.E.C. deep fat fryer. Centre: "New Connoisseur" café set (James Stott & Co.). Right: Crypto hand and face dryer





Left: "Ovenator" electric oven (Kitchen Machines Ltd.) and (right) Jackson Boilers "Filtesso" coffee maker

Ltd. This machine produces clear strong coffee under pressure in addition to a large output of boiling water. Jackson Boilers also have a new electrically operated coffee maker, the "Filtesso". The main loading is 7 kW plus 2 kW for the side containers, and it incorporates the "Filtomaton" system of coffee making for both the black Continental coffee or the English type. A safety device is incorporated and steam pressure is 5 lb.

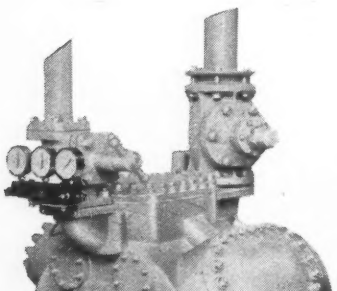
Dish washing and glass washing are well catered for and in addition to their already well-known "Kent" dishwashers, Max Arc & Electrics, Ltd., introduce their new "Miracle Maid" machine designed especially for schools, canteens, clubs and snack bars. The Insley Industrial Supply Co., Ltd., show an all-electric fully automatic Swiss dishwashing machine for large catering establishments which provides three separate washes and automatic rinsing and drying in hot air streams. This model can deal with crockery and silver ware at the rate of 600 - 800 main meals per hour.

Several new items are included in a wide range of "Creda" commercial catering equipment displayed by the Simplex Electric Co., Ltd. Creating widespread interest is the company's new "Chef's Range". This appliance incorporates an automatic heat controlled solid boiling top with a counterbalanced drop-down door. Oven temperature is controlled by a two-stage thermostat. Other new "Creda" items include a wall mounted hotcupboard designed primarily for the small school where space is restricted, and a quick-boil stainless steel water boiler which is produced in 3, 6 and 10 gal sizes and is provided with audible warning so that there is immediate notification of the water reaching boiling point.

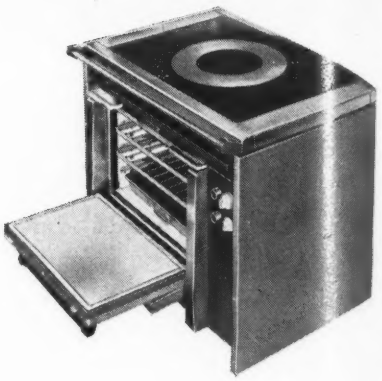
Electric potato peelers, chip cutters, coffee mills, mincers, food slicers, etc., are shown by Crypto, Ltd. At the same time the company exhibits the recently redesigned "Rotapan" steam cooker and its new hand and face dryer. Pedal operated, the latter stands 43in in height and is finished in vitreous enamel. Among a comprehensive range of stainless steel equipment shown by Benham & Sons, Ltd., are heavy duty ranges and deep fat fryer units, including a large display of caterers' cooking utensils.

Swift & Swallow's No. 32 mincer incorporates several modifications including a 1½ h.p. motor, a larger feed outlet with guard, and a rifled barrel. A chute guard can now be fitted as an optional extra to the "Swallow" slicer, in addition to the specially designed knife guard and safety switch, claiming to make it the safest slicer in the world.

New Lightfoot Refrigeration exhibits include the W.61 ammonia compressor which is one of three ordered for use in Australia. It is designed for large scale refrigeration and air conditioning installations and incorporates a new capacity control of the suction valve lifting type which is operated by oil and controlled by solenoid valves. Other Lightfoot exhibits include air coolers



Lightfoot W.61 ammonia compressor



Simplex Electric Co.'s "Chef's Range"

suitable for use in beer cellars, refrigerated display counters and bottle cooling trays. A display case of a new design which enables the whole of the display section to be available for storage is shown on the "Prestcold" stand. The latest refrigeration equipment, including the company's automatic "Electric Defrost" system, is displayed by Frigidaire.

A rotary sausage griller, the "Roto-Grill", to be seen on Taylor Stainless Metals' stand has a capacity of 50 sausages at one time and the latest models are now "Simmerstat" controlled. For serving hot rolls, saveloys, etc., the "Savro" cabinet (Modern Metal Products) should prove popular with the snack bar owner. Of stainless steel construction it has a glass fronted door and the loading is 850W. A semi-automatic butter spreading machine to be seen on the Euk Catering Machinery stand will butter slices of bread and is extremely simple in construction. It can be operated at up to 50 slices per minute. Fairfax Engineering, Ltd., have two new pieces of equipment, the first an electric deep fryer with a cold zone bottom to prevent burning and to allow several foods to be fried together, and the second a wall type food mixer. The food mixers of the Hobart Manufacturing Co., Ltd., include a new 30 qt capacity model.

Floor cleaning apparatus of all kinds is exhibited by Columbus-Dixon, Ltd., and among the cleaners displayed by Hoover, Ltd., is the model 912 which has been especially reinforced for cleaning carpets in public buildings.

Electric Heating in Council Houses

BIRMINGHAM House Building Committee is to examine a suggestion by Councillor R. A. Holland that the Committee should build electrically heated council houses as an experiment. He said that installing electric heating would save about £150 per house in building costs by eliminating chimneys, fireplaces, fuel stores, etc., cut fuel bills for the tenant by 5-8 per cent, and help in the fight to achieve a smokeless Birmingham in ten years.

Councillor Holland said that he had been making an inquiry into the subject and these figures were experts' estimates. The Corporation was at present building about 1,500 ordinary houses a year. This would bring a reduction of more than £150,000 a year in house building costs, which could help rents. Coal prices had gone up eight times as fast as electricity costs since 1938. This meant that coal had become uneconomic to burn in open grates for heating. Another advantage was that electric heating would permit better control of temperature and would enable tenants to decide what degree of heat they wanted in different rooms.

Councillor Holland has already experimented with electric heating in his own home and said that he was surprised when he started checking up on comparisons with coal heating. It was possible to reduce fuel bills considerably.

VIEWS on the NEWS

By REFLECTOR

MY "sixty years ago" note in the *Electrical Review* of 20th January prompts Mr. Harry Moss, of Bradford, to tell me of his experiences with Röntgen rays (or X-rays) at the beginning of this century. He was with a firm of electrical engineers who set up an X-ray exhibit at a trade show in the Potteries. There was a Crookes tubes and a sensitive fluorescent plate about a foot square. The tube was excited by a Tesla coil under whose influence the operator's hair stood out like needles if he went too near. Mr. Moss used for demonstration purposes an orange into which pins and pieces of wire were inserted; pieces of metal inside a wooden box; and his own hands. He says he obtained some very good results.

* * *

Co-operation between the gas and electricity supply industries is feasible where, generally speaking, "co-ordination" is not. An example of sensible collaboration is provided by the arrangement at Cowes, Isle of Wight. Here the local Gas Board is putting a new gasworks into commission in a few months' time. Coal for the works comes by sea to a wharf belonging to the Gas Board near the Central Electricity Authority's station at Cowes. The Southern Division of the C.E.A. has an agreement with the Gas Board by which coal for the power station is landed at the wharf which has the effect of lowering the Division's coal costs. The only possible difficulty seems to be the simultaneous arrival of the Board's and the Division's colliers but satisfactory arrangements have been made to avoid this.

* * *

An Edinburgh correspondent to the *Manchester Guardian* says that, needing a new 25 W lamp he went to "three or four first-class electricians in the town and was told the price of plain ones was 4s 8d and the pearled ones were a few pence cheaper." So he went to a chain store and got a plain one for 1s 9d. He then goes on about "closed shops," "price rings" and "fiddling in general." I had no idea that lamps were so dear in Scotland, but perhaps it is only the "first-class electricians" who charge so much. After he had been put right by Mr. E. B. Sawyer manager of the Lighting Service Bureau, he wrote to point out that a vital word had been left out of his letter: he had said "candle lamps."

* * *

A correspondent says that there has always been a friendly rivalry between electrical and mechanical engineers over the relative status of their respective technologies. The old mechanical engineer had no respect for electrical technology because he knew little about it. The old electrical engineer also would doubtless have dismissed mechanical technology but for the fact that he had to be familiar with it so that he could clothe his intangible force in a palpable and respectable carcass. Now, strangely enough, the mechanical man is coming to respect electrical technology through the influence of one its branches which is still viewed as somewhat esoteric by many electrical engineers themselves. The mechanical man is being won over by electronics. In a paper to the North Western Branch of the Institution of Mechanical Engineers, Messrs. R. B. Sims and P. Briggs discussed "The Application of Electronic Instruments to Mechanical Engineering" and gave examples of how they had been applied successfully to mechanical problems particularly in the iron and steel industry. Senior mechanical engineers should, they said, become familiar with the terminology and technology of electronics; for it was, and would increasingly become, a most useful tool. They were, however, warned to consult the electronic engineer before embarking on any scheme that might commend itself to them lest they should build an electronic sledge hammer to crack a mechanical nut. When a scheme had been accepted and entrusted to the electronic engineer, the responsibility for siting and mechanically protecting the electronic units in the plant still rested with the mechanical engineer. Development of suitable and accurate electronic devices was often a long and costly business and the mechanical engineer was advised not to attempt any cheese-paring, because he would find the ultimate result well worth the initial cost.

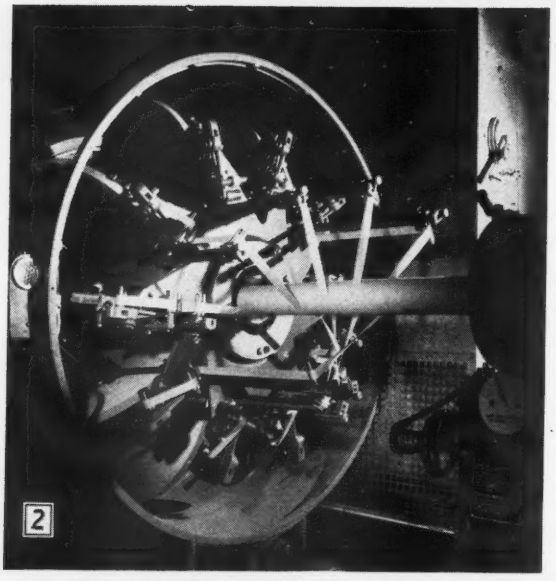
* * *

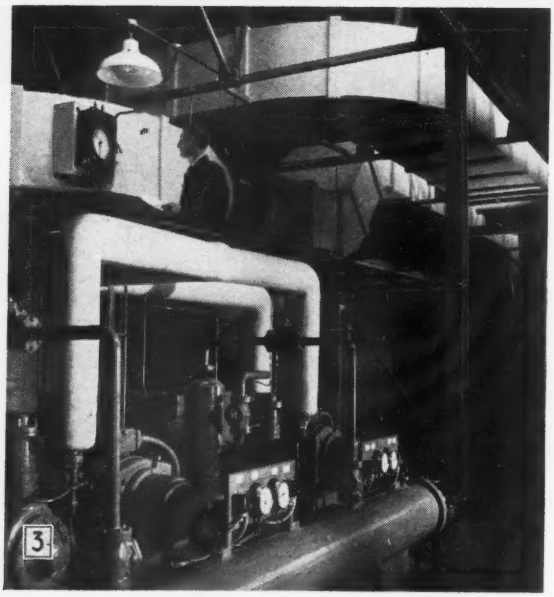
An unusual switching-on ceremony took place last week at Ellisland Farm, in the South of Scotland Electricity Board's area. This farm was at one time occupied by Robert Burns and his wife, Jean Armour, and the Board therefore arranged a pageant as part of the Burns Day celebrations on 25th January, the poet's birthday. Members of the Board's Dramatic Society, impersonating Burns and a party of his friends, drove to the house in a coach drawn by two grey horses, accompanied by "Tam o' Shanter" riding a grey mare. After closing the main switch, "Burns" explained the various electrical devices as they toured the farmstead. For this the poet's impersonator was well named, the part being played by Mr. John Power, from the Board's headquarters in Glasgow. On the previous night at Dumfries the Electricity Players had staged a one-act play, "A Licht wi' Burns," specially written by David Murray.

* * *

Going back eighty years, to the *Electrical Review* of 1st February, 1876, I found a report of a Christmas Lecture at the Royal Institution by Professor Tyndall in which he endeavoured to explain electrical induction. His account of Symmer's theory reads a little strangely. It supposed that:—

> ". . . . electric action is produced by two fluids, each self-repulsive but mutually attractive; that these fluids cling to the atoms of matter and carry them along with them; that every body in its natural condition possesses both fluids in equal quantities, mixed together and neutralising each other; and that these fluids are torn asunder by friction, one clinging to the rubber, the other to the body rubbed. In connection with this theory, he proceeded to exhibit and elucidate the phenomena of electric induction—that is, the decomposition of the neutral fluid in a body by the mere presence of an electrified body, without contact, also termed electrification by influence."





Cable Making and Testing

PAPER LAPPING OF 301 kV OIL-FILLED CABLES IN CONDITIONED ATMOSPHERE

LAST week we had an opportunity of inspecting a 150 ft long cable paper lapping machine recently installed at the Eastleigh (Hants) factory of the Pirelli-General Cable Works, Ltd., a company owned jointly by the General Electric Co., Ltd., and Pirelli S.A., Milan. This machine is designed to apply up to 200 layers of paper to a cable under precisely controlled tension and registration and, moreover, it is in a fully air-conditioned enclosure which enables the lapping process to be carried out in a uniform and favourable atmosphere.

The machine was designed and made by Pirelli S.A. particularly for insulating oil-filled cables to work at 301 kV (the highest rated cables to be made in this country so far) which have been and are being supplied for the Kemano-Kitimat undertaking of the Aluminum Co. of Canada. Until recently it was considered that the permissible working stress of the insulation in oil-filled cables should not exceed 90 kV/cm. It was felt that this limitation would unreasonably increase the dimensions of a 301 kV cable and that a working stress of 120 kV/cm was feasible with a higher quality dielectric.

Wrinkles and creases in the paper can occur when the lapped core is being taken round the haul-off wheel of a lapping machine or when it is being wound on a drum preparatory to drying. These defects are said to be caused by the inability of the layers of paper to slip one on another when the cable is bent, with the result that layers on the inside of the bend buckle in the spaces between the outer layers. The trouble can be overcome by careful control of the tension of the paper during lapping and by grading tension radially through the insulation. To achieve this it is necessary to know and control the moisture content of the paper so that due allowance can be made for shrinkage during drying.

The Eastleigh machine consists of twenty reversible revolving lapping heads each taking and applying ten reels or pads of insulating paper; it is thus capable of putting on 200 layers in one serial operation. The tension of the paper is maintained by an adjustable spring controlled band brake which acts on the pad holder. The paper passes to the cable over four rollers, one of which is attached to the pivoted lever which is itself spring controlled and coupled by linkage to the band brake. By this means centrifugal forces are nullified and tension is maintained even when the machine is stopped and a slight backlash occurs. Registration of the tapes is controlled by a fine screw adjustment on the last of the four rollers and there is provision for moving all ten holders of a head simultaneously to ensure that the centre planes of the pads are tangential to the cable.

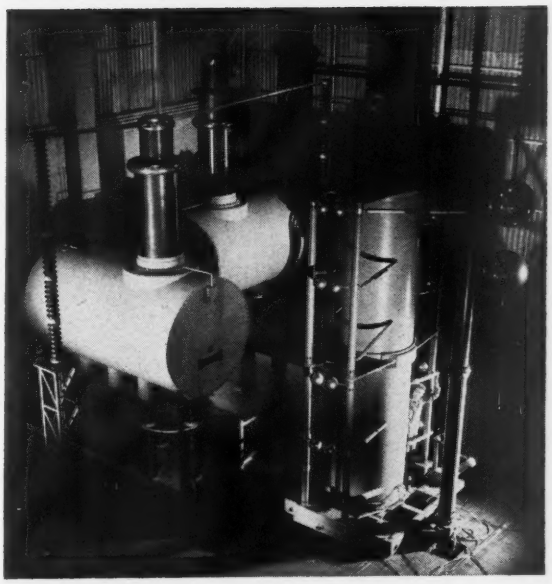
(1) 150 ft long 20-head paper lapping machine in its air-conditioned enclosure, (2) View of one of the heads carrying ten pads or reels of paper tape and (3) Air-conditioning equipment and ducting

Each of the twenty lapping heads is driven through a positive infinitely variable speed gear and the direction of rotation can be changed by the movement of a small lever. There are stopping and starting push buttons on each head and all heads are braked together by an electro-hydraulic mechanism. A transparent guard on each head operates a knock-off device when lifted and this device also stops the machine if a tape breaks or runs out; at the same time a red lamp lights up on the head affected. The cable is pulled through the machine by a caterpillar type haul-off.

An air duct runs the full length of the paper-lapping enclosure and conditioned air is emitted from a number of louvres across the top of the enclosure. After circulating, the air is extracted through floor-level outlets and returned to the conditioning plant, a proportion of fresh outside air being continuously added. The conditioning plant is designed to maintain constant temperature (70 deg F) and relative humidity (40 per cent) in the enclosure whatever outside conditions may be.

After being cut and reeled ready for use the paper is stored for about a week on racks in the air-conditioned enclosure to reduce the moisture content to the desired level.

Testing facilities at the Eastleigh works have recently been rearranged and augmented to enable development and type tests to be carried out on very high voltage cables. In the development bay a compact Micafil (Swiss) impulse generator has been installed. It has a stored energy capacity of 38,500 watt-seconds and an open-circuit voltage of 1,600 kV peak and it is capable of applying impulses up to 1,400 kV peak on samples of cables, with accessories, up to about 25 yards in length. The capacitors are contained in a central bakelised-paper column and the charging unit is a mechanical rectifier



The newly-equipped development bay at the Eastleigh works with the Micafil impulse generator in foreground

operating at 200 kV d.c. Also in the development bay are two 330 kV Ferranti transformers which can be operated in parallel or cascade to give 660 kV to earth, impulse and a.c. voltages being measured by a gap between two 1-metre diameter copper spheres. For the routine testing of long lengths of h.v. cable there is a pair of 220 kV max. transformers with a combined rating of 1,600 kVA continuously or 2,800 kVA for half an hour.

Electricity in Gas Works

INCLUDED in a paper on steam and power in the gas and coking industry, which was presented by Mr. L. J. Clark (North Thames Gas Board) before the Institute of Fuel on 18th January, was a section on the use of electricity. The policy of the N.T. Gas Board, the author stated, was to link most of the works with the public supply system but to retain some internal generating capacity, usually oil or gas engines, either as stand-by or for running in parallel with the public network. Where the m.d. was under 100 kW public supply became the most economical, but if it exceeded 250 kW and waste heat or coke breeze was available, internal generation would be cheaper.

The primary system of the modernized Beckton works consisted of a 22 kV ring main fed at two separate points from the public supply system with provision for 10 to 12 MW. On it were four substations stepping down to a 6·6 kV system, to which were connected the works generators and several smaller substations for local distribution at 400 V. Circuit breaker rupturing capacities were 350 MVA at 22 kV and 150 MVA at 6·6 kV. The aggregate horse-power of steam prime movers and electric motors was 44,000, or 280 h.p. per million cu ft of gas-making capacity per day. The number and h.p. of electric motors amounted to: 685 for mechanical handling equipment, 10,530; 11 for gas pumping, 1,932; 680 for other pumps and miscellaneous drives, 10,543.

In the Board's works as a whole the demand varied from 8 to 18 kWh/ton of coal carbonized, the latter figure applying to the more extensively mechanized larger works. These were equivalent to 0·09 and 0·20 kWh/therm of mixed gas containing 20 per cent of carburetted water gas. When full electrification of the larger works had been completed the demand would rise to 0·24 to 0·28 kWh/therm costing about 0·33 d. The lighting load represented 15 per cent of the total, a proportion that was expected to increase. Overall load factor of electricity supply in gas works ranged from 40 to over 50 per cent and tended to rise as electrification was extended.

Power Reactors

UNDER the title of "Peaceful Uses of Atomic Energy," the United Nations organization is publishing in sixteen volumes the text of the 1,050 papers presented before the international conference at Geneva last August and a verbatim report of the ensuing discussions. Of most importance to electrical engineers is the volume (No. 3) on Power Reactors (393 pages, H.M. Stationery Office, P.O. Box 569, London, S.E.1, 54s.). The subject is dealt with in thirty papers in six main sections on fuel cycles, experience with nuclear power reactors, design of reactors for power production (2 sections) and prototype reactors (2 sections). At the end of the volume leading particulars of 42 reactors are tabulated in five groups in regard to: name and location; power level (heat rating in kW); flux in neutrons/cm^2/s; fuel used and arrangement of fuel core; reflector; shielding; overall size; control methods; coolant; remarks. General features of reactors under construction or planned are also given.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Metropolitan-Vickers Electrical Co., Ltd., announces that **Mr. C. H. Flurscheim,** B.A., M.I.E.E., M.Am. I.E.E., who since 1953 has combined the post of assistant chief electrical engineer with that of chief engineer, Switchgear Department, will devote the whole of his time to the former appointment. **Mr. E. Nicholson,** M.B.E., T.D., B.Sc., A.M.I.E.E., has been appointed chief engineer, Switchgear Department.

Mr. E. Nicholson

Mr. Nicholson was educated at Denstone College and Manchester University. He joined the Metropolitan-Vickers Electrical Co., as a probationary college apprentice in 1933, and on completing his course joined the Switchgear Department. From 1939 to 1946 he served with the Royal Corps of Signals in North Africa and Italy, being awarded the M.B.E. and mentioned in despatches; he also received the Legion of Merit (U.S.A.). Returning to the Switchgear Department in 1946, he became division leader (large panels) in 1951, and assistant chief engineer in January, 1955.

Mr. R. W. C. Reeves, a director of Johnson and Phillips, Ltd., has been elected chairman of the Cable Makers' Association for 1956, **Mr. J. S. A. Bunting,** a director of the Edison Swan Electric Co., Ltd., has been elected vice-chairman and **Mr. R. A. Bebb** of Crompton Parkinson, Ltd., continues for a second year as chairman of the Mains Cable Manufacturers' Association. **Mr. H. B. Davies** of Enfield Cables, Ltd., has been appointed chairman of the Mains Cable Manufacturers' Association (Super Tension), **Mr. N. B. Frost** of W. T. Henley's Telegraph Works Co., Ltd., has been appointed chairman of the Overseas Rubber Cable Makers' Association and **Mr. H. H. Townsend** a director of the Greengate and Irwell Rubber Co., Ltd., has been re-elected chairman of the Rubber and Thermoplastic Cable Manufacturers' Association.

Mr. V. A. Pask, C.B.E., M.I.E.E., M.I.Mech.E., who recently retired from the position of chief engineer to the Central Electricity Authority, is shortly taking up duties as power generation consultant with John Brown & Co., Ltd.

At a board meeting held on 24th January the directors of Gent & Co., Ltd., Leicester, elected **Mr. O. E. Kinsey** chairman of the board in succession to **Mr. A. R. Leivers** who has retired, while still retaining a seat on the board. Mr. Leivers, who has been chairman of the company since 1935, joined the company as secretary in 1903 and resigned this position on being elected a director in 1915. Mr. Kinsey joined the company in 1912 as cashier and succeeded Mr. Leivers as secretary in 1915. He was appointed a director in 1949.

Mr. C. L. G. Worn, B.Sc.(Eng.), A.M.I.Mech.E., who has been chief gas turbine engineer with the Brush Electrical Engineering Co., Ltd., Loughborough, since 1952, has been appointed chief engineer of the company's Turbine Division. He will be responsible for the development, design, drawing and testing of steam turbines, in addition to his present responsibilities for gas turbines and turbo-superchargers. He suceeds **Mr. R. C. McLeod,** who has relinquished executive responsibilities in order to devote his time to technical design.

Mr. Worn began his career at Rolls Royce, Ltd., Derby, and after serving his apprenticeship was engaged in the development of aero gas turbines. In 1947 he joined the British Thomson-Houston Co., Ltd., Rugby, and spent five years in the Gas Turbine Department on industrial machines before taking up his position with the Brush Co. Since 1954 he has been hon. secretary of the East Midlands Branch of the Institution of Mechanical Engineers.

Mr. L. A. Benn, A.M.I.Mech.E., A.M.I.E.E., is promoted from chief designer, turbo-generators, to chief engineer, Heavy Electrical Plant Department. Mr. Benn began his career as a drawing office apprentice with the Brush Co. in 1936 after studying at Loughborough College, and later served in the Electrical Test Department and on electrical machine design. On his return to the Brush Co. after the war he spent some time on the production side of the works before becoming chief designer, turbo-generators. The present chief designer of the Brush Ljungstrom radial flow steam turbine, **Mr. L. E. Robinson,** will continue in that capacity. **Mr. J. R. Hutchings,** formerly assistant to the chief engineer, has been appointed engineer in charge of spares and repairs.

The Stella Lamp Co., Ltd., announces the appointments of **Mr. T. R. Marr** as manager of its Lamps and Fittings Department (Home and Export) and of **Mr. W. B. P. Grey** as southern area sales supervisor.

Mr. T. R. Marr

Mr. W. B. P. Grey

Mr. Marr joined the Stella Co. as office manager in 1949. Previously he had served for nine years in the R.A.S.C., attaining the rank of captain.

Mr. Grey joined the company in October, 1953, as a representative in the London area, and was appointed London sales supervisor in April, 1954. He was formerly employed in the plastics industry.

Mr. P. J. Osborne has been appointed manager of the Leith depot of the Marconi International Marine

Mr. R. W. C. Reeves

Mr. J. S. A. Bunting

Mr. R. A. Bebb

Mr. H. B. Davies

Mr. N. B. Frost

Mr. H. H. Townsend

Communication Co., Ltd., in succession to **Mr. A. F. Harrison,** who has resigned that position owing to ill-health and is taking up another appointment in Glasgow.

Mr. S. E. Harris, who writes in this issue on "Lighting in Oil Refineries," joined Holophane, Ltd., in 1930 and was attached to the Technical Service Department, with responsibility for the photometric laboratory. In 1934 he was appointed district engineer for East Anglia. In 1940 he was transferred to the Ministry of Supply as a lighting inspector in connection with the improvement of artificial lighting in vital factories. Since 1945, when he rejoined Holophane, Mr. Harris has been district engineer in London and the home counties and he has also been specially concerned with oil refinery installations for the last six years.

Mr. S. E. Harris

Mr. B. Smith, A.M.I.Prod.E., and **Mr. C. E. Middlemiss,** B.Com., M.S.M.A., have been appointed directors of Clarkson (Engineers), Ltd. Mr. Smith has been works manager since 1951 and Mr. Middlemiss joined the company as sales manager in 1952.

Commander P. W. Kent, R.N., chairman and managing director, presided at the annual apprentice prize giving of **George Kent, Ltd.,** at Luton on 16th January. The guest speaker, Mr. A. J. Young, president of the Society of Instrument Technology, reminded the apprentices that there had never been so many opportunities and facilities as now. The major prizes presented by Commander Kent were the challenge cup bearing his name to Mr. H. R. Ledger, the Sir Walter Kent prize to Mr. J. C. Keeling, the R. W. Bedford challenge cup to Mr. E. L. Amiss, and the Grout prize to Mr. W. Carrington. An exhibition held in conjunction with the prize-giving included a wide range of models and pictures illustrating the training and work of apprentices.

After thirty-two years with Chloride Batteries, Ltd., and more than fifty years connected with battery applications, **Mr. J. Hamilton,** A.M.I.E.E., has retired from the position of Exide Midland sales engineer.

Mr. W. J. P. Watson, F.I.E.S., retired on 31st December from the honorary secretaryship of the Illuminating Engineering Society, Birmingham Centre, a position he had held for the last ten years. Mr. Watson is a founder member and past-chairman of the Birmingham Centre and will in future look after its social activities.

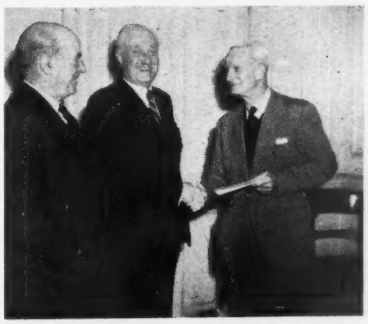
Mr. J. Eccles, deputy chairman (operation) of the Central Electricity Authority and past-president of the Institution of Electrical Engineers, is to have the honorary degree of D.Sc. conferred upon him by the Queen's University, Belfast. Mr. Eccles is a graduate of the University.

Mr. Albert Williams, M.I.E.I., has retired from Foster Transformers, Ltd., after fifty-one years' service with the company, and at a recent gathering of his colleagues presentations were made to him of a wallet and cheque from the management, an inscribed silver teapot from the staff and an illuminated certificate from the directors of Lancashire Dynamo Holdings, Ltd., the parent company. The presentations were made by Mr. R. V. Ely, managing director of Foster Transformers, Ltd.

Mr. Williams joined the company at the age of sixteen, became chief inspector in 1930 and service manager in 1944.

Mr. A. Williams (left) receiving presentations from Mr. R. Ely on his retirement from Foster Transformers, Ltd.

Mr. C. N. Good, who has just retired from the sales staff of Chloride Batteries, Ltd., was recently paid two signal honours by the Royal Navy. For more than forty years Mr. Good has acted as liaison officer with the Admiralty for the supply of "Exide" submarine batteries. As a mark of the Submarine Command's appreciation of his work he was invited to attend, as a guest of honour, the annual submarine officers' reunion at Fort Blockhouse, Gosport. One of only two special guests—the other one was Admiral Lord Mountbatten, the First Sea Lord—Mr. Good was the first civilian ever to attend this function. Just before his retirement, a model of a modern "A" Class submarine was presented to him by the Flag Officer Submarines, Rear-Admiral W. J. W. Woods, D.S.O. Mr. Good first joined the company in 1909 and he is now succeeded by **Commander H. T. Powell** R.N. (Retd.), A.M.I.E.E.



Mr. C. N. Good (right) who recently retired from the staff of Chloride Batteries, Ltd., receiving a cheque from Mr. A. W. Browne, chairman of the company. With them is Mr. H. V. Schofield, a director. On the table in front of Mr. Good is the model submarine presented to him by the Flag Officer Submarines.

The **E.D.A. Carnival** held on 13th January at the Oxford Galleries, Newcastle-on-Tyne, proved a successful social function, over 1,000 guests attending. During the evening a number of prizes awarded by all sections of the industry were distributed. Since the inception of the Carnival £6,590 has been paid to electrical charities. The accompanying picture shows Mrs. E. M. Wiggans presenting a bouquet to Mrs. S. G. Pike, wife of the chairman of the E.D.A. Carnival Committee.

Two expert sub-committees of the **International Electrotechnical Commission** are meeting at British Stan-

At the E.D.A. Newcastle Carnival showing (left to right), Mr. S. G. Pike, Mrs. Wiggans, Mrs. Pike, Mr. A. Parkin (hon. organizer of the Carnival) and Mr. E. M. Wiggans

At the annual dinner of the Birmingham Centre of the Illuminating Engineering Society, showing (left to right) Lt.-Col. G. A. Gould, chairman, Stoke-on-Trent Group; Mr. J. N. Walker, chairman, Leicester Centre; Dr. J. W. Strange, vice-president, I.E.S., London; Mr. G. R. Hanson, chairman, Birmingham Centre; Mr. H. G. Campbell, managing director, The Benjamin Electric, Ltd.; Mr. G. F. Cole, secretary, I.E.S., London; and Mr. P. A. Moore, chairman, Nottingham Centre

dards House, 2, Park Street, W.1. They include representatives from Belgium, Czechoslovakia, France, Hungary, Italy, Switzerland, the United Kingdom and the U.S.S.R. Mr. L. H. Welch, chief engineer of the London Electricity Board, presided at a luncheon on 26th January at which Dr. P. Dunsheath, president of the I.E.C. and a member of the London Electricity Board, stressed that this was one of the few international commissions which worked without regard to race or political creed; he was pleased to see that so many representatives from Eastern Europe were able to attend and he hoped that the work of the committees would be fruitful. The sub-committees, which were set up to expedite the work of the I.E.C. technical committee dealing with measuring instruments, are concerned with indicating instruments and with watt-hour meters.

Parkinson & Cowan, Ltd., announce the retirement from executive duties in the group of companies of **Mr. R. Connor,** O.B.E., A.M.I.E.E., as from 1st February. He has relinquished his directorships in the parent company and various subsidiary companies and also his appointments as chairman of the hydraulics division and the instruments division, but will be available to the group in an advisory capacity. **Sir Geoffrey Vickers,** V.C., has been elected a director of Parkinson & Cowan.

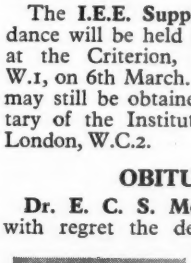
The second annual general meeting of the North Metropolitan Branch of the **Electrical Industries Benevolent Association** was held at Northmet House, Southgate, N.14, on 13th January. The chairman's report showed that good progress had been made during 1955, and a point of special interest was that the annual function held last year resulted in a contribution of approximately £100 to the funds of the Association. A similar function will be held on 20th April at the Waterend Barn, St. Albans. The retiring Committee was re-elected *in toto*, and the following officers were elected for the year:—Chairman, Mr. C. R. Marshall; vice-chairman, Mr. H. G. Campbell; hon. secretary, Mr. T. Yule; and hon. treasurer, Mr. V. A. Colmer.

Mr. S. B. Hainsworth, managing director of J. H. Fenner & Co., Ltd., and J. H. Fenner & Co. (Overseas), Ltd., is now on his way to India where he hopes to be present on the occasion of the commencement of operations of Fenner-Cockhill, Ltd., a new manufacturing organization set up in Southern India.

The **I.E.E. Supply Section** dinner-dance will be held in the Grand Hall at the Criterion, Piccadilly Circus, W.1, on 6th March. Tickets (£1 10s.) may still be obtained from the secretary of the Institution, Savoy Place, London, W.C.2.

OBITUARY

Dr. E. C. S. Megaw.—We report with regret the death of Mr. Eric Christopher Stanley Megaw, M.B.E., D.Sc., M.I.E.E., at the age of forty-eight; he was Director of Physical Research at the Admiralty. Dr. Megaw was born in Dublin in 1908 and was educated at Queen's University, Belfast, and the Imperial College of Science, London. While still at college he became interested in radio transmission and reception and at the age of twenty-one was elected a research fellow of London University. He joined the G.E.C. Research Department in 1930 under the late Sir Clifford Paterson, and his work came to the notice of the late Lord Rutherford and of Marconi. His development of methods of generating very short radio waves gained him the Duddell Premium of the I.E.E.



The late Dr. E. C. S. Megaw

He was a member of a group which studied the application of short waves for naval purposes on behalf of the Admiralty, including radar applications and later (in 1946) he was appointed to superintend the radar branch of the Admiralty Signal Establishment. Dr. Megaw leaves a widow and two sons.

Mr. Harry Allcock.—In our report last week of Mr. Harry Allcock's death we said that he had been with W. T. Glover & Co., Ltd., for 55 years. He actually joined the company in 1900, was export manager for nearly a quarter of a century, and retired in 1951.

Mr. Frank Ayton, M.I.E.E., a former joint managing director of Ransomes, Sims & Jefferies, Ltd., and a strong advocate of the electric battery vehicle, died on 24th January at the age of eighty-four. Mr. Ayton received his practical training with Siemens Bros., Woolwich, and was on the staff of the company from 1893 to 1898 when he became assistant to the late Sir Alexander Kennedy. In 1903 he was appointed chief engineer and manager of the Ipswich Corporation electricity supply and tramways and while holding this position was president (in 1919) of the Incorporated Municipal Electrical Association. He joined Ransomes, Sims & Jefferies in 1921 and retired from the position of joint managing director and works director in 1946, although he remained on the board of the company until 1950.

Mr. Frederick W. Bennion, for many years superintendent of the power stations at Canterbury and Folkestone, has died in the Royal Masonic Hospital at the age of sixty-one.

Mr. S. G. Marston.—The death occurred on 13th January, at the age of seventy-four, of Mr. S. G. Marston, who was general manager and engineer of the Stockton-on-Tees Corporation Electricity Department from 1921 until his retirement owing to ill-health in 1945. Before going to Stockton Mr. Marston was mains engineer at Sunderland, and previously he was with the Stoke-on-Trent Corporation.

R. S. Whipple Fund

The Cambridge University Authorities have accepted the bequest of the late Mr. R. S. Whipple of a third of his residual estate, subject to life interest in favour of his widow. The value of the bequest is about £20,000 and it will be added to the R. S. Whipple Fund.

Financial Section

STOCKS and SHARES

STOCK EXCHANGE markets are looking forward to the season of company results and dividends for 1955 with a measure of optimism more cautious than that which prevailed a year ago in the same respect. So far as dividend decisions are concerned, it is recognized that these will have to be taken in the face of the credit shortage, with its inducement to conserve cash, and of the Prime Minister's appeal for the use of increased profits in lowering prices rather than in distributing more. From the earnings point of view, the impression grows that profits in many sectors are becoming harder to produce, with margins squeezed by rising costs and business affected by the Government measures of restraint. In connection with profit margins, references are being made to the results published last month by such companies as Decca, who reported little change in the trading surplus from a year of substantially increased turnover.

Uncertain Markets

Meanwhile, the investment prospect is described in the markets as presenting little to "go for" until further evidence accumulates on the question of whether Government measures have yet gone far enough to perform their disinflationary purpose, or whether the new Chancellor will have in due course to take other steps to reinforce them. This means that the gilt-edged market still cannot feel sure that Bank Rate has reached the top at 4½ per cent, and that the outlook for industrials is correspondingly obscure. Share prices have, however, already gone a long way towards discounting the doubtful factors. In the market for electrical equipment shares, for instance, the decline in A.E.I. ordinary amounted to as much as 12s in the first four weeks of January alone, and to more than double that figure since the high prices recorded last summer.

Taking a View

There have been signs at times lately that the fall of quotations in the electrical equipment group, as well as in other sections of the industrial market, has reached a level interesting to investors prepared to take a view. In most cases, the maintenance at least of the last rates of dividend seems reasonably well assured, and, on this assumption, a present buyer can see the prospect of an attractive return on his money while waiting for the great potentialities of the electrical, electronic and atomic power industries to develop. On the shares of the big groups, it is true, yields are still below the gilt-edged level, but returns of 5 to 6 per cent have been showing lately on the shares of companies in the class of Allen West, Crompton Parkinson, Chloride Electrical, Electric Construction, Ever Ready, Murphy, Telegraph Construction, and Walsall Conduits; and above 6 per cent in those of, for instance, Crabtree Electrical, Brush, Henley's, Johnson & Phillips and many others.

James Scott Interim

An interim dividend of 5 per cent declared by James Scott & Co. (Electrical Engineers) is at the rate indicated in the particulars published in connection with the marketing of the shares in London and Glasgow last August. At about 12s 6d the 5s ordinary shares stand 1s above the price at which they were then placed. The financial year of the company ended with January. For this period, the directors' forecast (subject to the usual reservations) was a profit of not less than £140,000 and, on this estimate being realized, a total dividend of 17½ per cent for the year. Such a distribution would be covered approximately twice by the indicated earnings, and would produce a yield of 7 per cent on the shares at their present price. The final distribution is expected in September. The 6½ per cent preference shares, marketed at the same time, have been available lately at a little under par. Issued capital consists of £254,037 in ordinary, and £200,000 in preference shares.

Other Interims

An increase from 7½ to 10 per cent in the Hackbridge Cable interim dividend for 1955-56 helped the 5s shares to maintain their uncommon distinction of standing at or about their all-time high point. It is recalled that only a small proportion of the company's newly acquired Bryce-Siemens unit profits was available for dividends in respect of last year, when a total of 25 per cent was distributed. At that rate, the yield on the shares at 23s 9d works out at 5¼ per cent. British Relay Wireless & Television (in which Pye and Murphy are closely interested) have declared an interim dividend of 5 per cent, the same as for last year, when the total was brought up to 16 per cent. The 5s "A" shares issued in October rank for this payment. They are quoted at 16s 3d, to yield a fraction under 5 per cent.

R. B. Pullin Results

R. B. Pullin & Co.'s 2s shares have been dealt in at a little over 7s since the declaration of the final dividend for the year ended in September. This brings the total to 20 per cent, which is 5 per cent more than the previous rate and puts the shares on a yield basis of 5·6 per cent. Disregarding special credits, the latest profits are much the same as before at £141,000, and provide three-fold cover for the ordinary distribution. Last year's balance sheet showed reserves totalling £257,000 against an issued ordinary capital of £175,000.

Hoover New Shares

Hoover's capital reconstruction plan having been approved, dealings now take place in the company's ordinary and "A" ordinary shares, both of 5s denomination and both at present quoted in old and new form. The former 1s shares have disappeared, having been replaced in such proportions that the holder of 100 now has 135 new "A" shares and 10 ordinary. These rank equally for dividends and have been changing hands at a shilling or so over 30s, with the ordinary standing slightly the higher. With the reconstruction proposal, the company gave an estimate that profits for 1955, affected by the new hire-purchase restrictions, are likely to have been in the region of £3¾ million (against £4½ million previously) and that the total dividend for the year will be between 60 and 70 per cent. The latter rate was paid for 1954.

Hall Telephone

The 10s shares of Hall Telephone Accessories, which were among last year's star performers in the industrial market, have remained near their peak price of 34s since news of a further stage in the evolution of the business along lines connected with automation, electronics and instrumentation. In the first place, it will be recalled, the company acquired the business of James Gordon & Co., and made contacts with the American firm of Panellit. As a result of proposals now announced, the H.T.A. business is to become in effect a subsidiary of a new company, Associated Automation, which will be organized with capital powers and management appropriate to its development in this specialized field.

The Wairakei Scheme

Because the cost of the proposed heavy-water plant at Wairakei, New Zealand, will be considerably more than was originally estimated, the United Kingdom Atomic Energy Authority has withdrawn from the scheme. The plant was to be erected near a generating station in which natural steam was to be employed. It is reported that the New Zealand Government will proceed with the proposed power station although Geothermal Development, Ltd., a company formed to build and operate the heavy-water plant, is to be wound up.

REPORTS and DIVIDENDS

Burco Dean, Ltd.—The main figures in the accounts for the first financial period from incorporation on 29th March, 1955, to 30th September last were given in our issue of 13th January. In his statement which accompanies the report and accounts, Mr. D. K. Ward (chairman), says that the result of high purchase restrictions, coupled with an increased purchase tax, is a severe drop in production. No parallel drop in the costs of production is evidenced, but on the contrary considerable increases in wages and cost of metals have occurred, with substantial price rises in coal, electricity, gas and petrol. The conclusion that profits must drop considerably is inescapable. It must be borne in mind that the demand for consumer goods is postponed and not satisfied, and when the time comes for the removal of restrictions it is important that the company should be ready.

Radio Rentals, Ltd.—In his statement which is circulated with the report and accounts for the year ended 31st August last, Mr. P. Perring-Thoms, chairman and managing director, says that public demand for the company's service continues at a high level with particular emphasis on television. The sales with service branch of the group made notable progress. With the commencement in May last of v.h.f. radio transmissions they were able to satisfy a strong demand for v.h.f. sets. The subsidiary companies, except Rentevision, Ltd., which has not traded, all earned profits during the year under review. Since the close of the financial year the company has further expanded the volume of business transacted and is achieving results fully comparable with those of the corresponding period of the previous financial year.

The Palestine Electric Corporation Ltd.—The subscription list opened and closed on 23rd January for an issue in Israel of two series of 6½ per cent 1958-65 bonds amounting to I£6,000,000 in all. The net proceeds will be applied in providing for the partial cost of the plant extension of the Corporation. With the present issue, the total loan capital will be brought up to I£16 million.

The General Electric Co., Ltd., has announced an interim dividend of 4½ per cent on £13,714,680 ordinary stock. A similar interim dividend was paid last year on £11,755,440 ordinary stock before the one-in-five rights issue of February, 1955.

Hackbridge Cable Holdings, Ltd., has announced an interim dividend of 10 per cent (against 7½ per cent).

James Scott & Co. (Electrical Engineers), Ltd., whose share capital was marketed in London and Glasgow last August, is paying an interim dividend of 5 per cent on £254,037 ordinary capital.

British Relay Wireless & Television, Ltd., has declared an interim "A" ordinary dividend of 5 per cent (same) on increased capital.

New Companies

Plessey Nucleonics, Ltd.—Registered 19th January. Capital £100,000. To conduct research into matters connected with the production and use of nuclear power and radioactive substances, etc. Directors: A. G. Clark, E. J. Earnshaw, M. W. Clark (all directors of the Plessey Co., Ltd.), and G. C. Gaut. Regd. office: 56, Vicarage Lane, Ilford, Essex.

R.T.E. Service, Ltd.—Registered 17th January. Capital £1,000. Electricians, radio, television and electronic engineers, electrical engineers, etc. Directors: F. G. Merkl, Jessie M. Merkl and F. A. Bell. Regd. office: 20, Bloomsbury Square, W.C.1.

Bankruptcies

W. V. Tupling, 27 Church Street, Warsop, Notts., electrician.—Receiving order made 16th January on debtor's own petition. Public examination 1st March at the County Court House, St. Peters Gate, Nottingham.

A. E. Thompson, 9, High Row, Darlington, electrical engineer and contractor.—Receiving order made 19th January on debtor's own petition.

F. M. Hitchcox, lately carrying on business as an electrical contractor under the style of Burroughs Electric Co., and as B.E. Co., at 2A, Langley Road, Watford, and formerly at 18, King Street, and 1, Church Street, Watford.—Trustee, Mr. B. Phillips, 76, New Cavendish Street, London, W.1, appointed 19th January.

Parliamentary Report

IN the House of Lords last week Lord Elibank said that among the exports to China embargoed in this country were power machinery, copper and alloys, but Western Germany in 1955 had exported such goods to China. He asked the Government to ensure that British industrialists were on an equal footing with their foreign competitors.

The Marquess of Reading, Minister of State, Foreign Office, said that the scope of the China trade controls was now under study in consultation with the United States. Business men here were on exactly the same footing as their competitors who were members of the Consultative Group dealing with the embargoes, including France, Japan and Western Germany. He understood that the items exported by Western Germany were not subject to the embargo.

Blyth Generating Station Bill

When the Blyth Generating Station (Ancillary Powers) Bill was reported, with amendments, to the House of Commons, Mr. Ian Mikardo moved to insert a new Clause entitled "Restriction on Employment." He said that there was an organization called the Foremen and Staffs Mutual Benefit Society operating in certain parts of the engineering industry which made it a condition of membership that the workers concerned should not be or become members of a trade union. Members were nominated by employers and the Society's funds came partly from employers. It involved a shameful restrictive practice, and he sought to amend the Bill so that a beginning could be made in one sector of industry towards ridding all industry of it.

Mr Arthur Palmer said that he supported the principle put forward by Mr. Mikardo but doubted whether it was right to attach such a big and important principle to such a small peg. It also seemed a little hard that the nationalized electricity supply industry, which had such a good history of labour relations, should be smeared—although he was sure that was not Mr Mikardo's intention—with any suggestion that it supported such vicious anti-trade union practices.

The amendment was withdrawn, and the report on the Bill was received.

Stella South Explosion

In reply to Dame Irene Ward, the Minister of Fuel and Power (Mr. Aubrey Jones) said it was now known that the cause of the recent explosion at Stella South power station was an external flash-over across the supporting insulators of an outdoor switch, followed by incorrect working of certain protective gear on the transmission system. Investigation was still proceeding to ensure that all possible measures were taken to prevent a recurrence of such incidents.

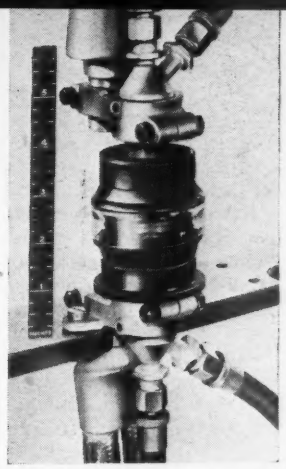
Pensions of Former Company Employees

Dame Irene Ward also asked the Minister about increased pensions to ex-employees of the nationalized industries under his control.

Mr. Aubrey Jones said he understood that the Central Electricity Authority was considering possible improvements in its original proposals for increasing the pensions of ex-company pensioners and that the other industries for which he was responsible were also considering what proposals they should make.

Progress in Manufacture

Activities of The General Electric Co., Ltd.



Experimental germanium power diode

SOME 410 MW of steam turbo-generating plant was commissioned in 1955 by the General Electric Co., Ltd., exceeding the total of any previous year. Commissionings overseas accounted for about a quarter of the plant, including Orlando power station, Johannesburg, for which ten sets totalling 337·5 MW have now been completed. Further orders for this type of equipment received during the year totalled 664 MW. Among 360 MW ordered by the Central Electricity Authority were a 120 MW set for Northfleet, two 60 MW sets for Poole and two for Bold. To help in the manufacture of heavy turbines a new shop at the Fraser & Chalmers Engineering Works of the company, designed for the erection and testing of the largest machines at present envisaged for power generation, was opened on 15th July by Lord Citrine.

During the year much development work was done on the direct cooling of large alternators to improve the dissipation of heat from the rotor windings.

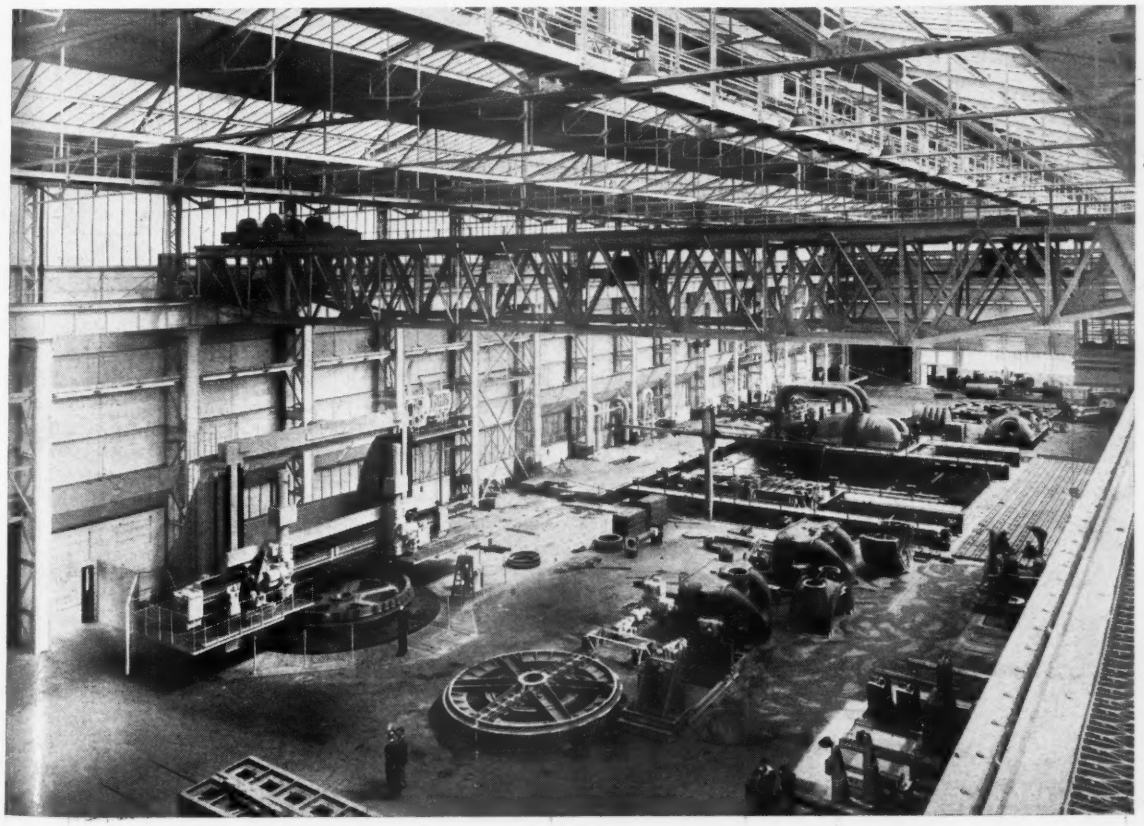
What is believed to be the largest compressed air installation in the world is now under construction to the order of the Ministry of Works. Totalling 352,000 h.p., it is four times the size of any other installation under construction or operating in this country and comprises eight identical sets, each consisting of an 8,000 h.p. turbine, two l.p. centrifugal compressors, one h.p. centrifugal compressor and a 36,000 h.p. synchronous motor, all coupled in line.

In the realm of hydro-electric plant a 62·5 MVA horizontal shaft alternator was commissioned in August at the Aura power station of the Norwegian State Power Company. This is driven by an Escher Wyss pelton wheel and is one of the largest of its type running on the continent.

Some 300 MVA of transformers were commissioned for the Central Electricity Authority and work completed for overseas customers included transformers for Winnipeg, India and Uganda. Eight 27·5 MVA 33 kV transformers are being supplied for the air compressor plant previously referred to.

A complete range of transformers with cold rolled steel cores has been produced to the specification of the Central

Interior of the new heavy turbine shop at the Fraser & Chalmers Engineering Works



Electricity Authority. The same material is also being used for a number of 5,000 kVA transformers being built for the South Western Electricity Board.

Extensions have been made to the switchgear testing facilities, which are now available for testing circuit breakers of 2,500 and 3,500 MVA breaking capacity at 132 kV when rupturing current at a leading power factor. Arrangements have been made with the Central Electricity Authority for using a 132 kV line which runs immediately behind the high power testing station at Witton, during week-ends.

A new frame mounted 500 MVA oil circuit-breaker using a single tank and suitable for use on 11 kV and 15 kV systems has been introduced, designed to meet the requirements of the Canadian market. Steady demand for outdoor circuit-breakers has continued at home while overseas contracts included five 132 kV and ten 66 kV oil circuit breakers for an Indian substation. Metalclad switchgear commissioned at home includes forty-two units of 500 and 250 MVA at substations of the London Electricity Board.

During the year over 50 per cent of the orders placed for mercury arc rectifiers were for overseas use, a noteworthy order being that for twelve 1,224 kW rectifiers for the Netherlands Railways, bringing the total capacity supplied for that system up to 61,000 kW.

A considerable increase has taken place in the orders for winders, both a.c. and d.c., for the National Coal Board. Two interesting installations commissioned during the year were at Chislet Colliery, Kent and Cwm, South Wales. Both of these incorporate a system of a.c. speed control providing a direct relationship between the steady rope speed and the position of the driver's control lever.

At two other collieries 3,200 h.p. geared d.c. double drum winders are being commissioned, designed to raise 12 tons of coal per wind from a depth of 2,299ft and giving an hourly output of 525 tons, Ward Leonard control being used. At Bold Colliery in the North Western Division, a Koepe friction winder has been installed believed to be the largest of its kind working in the country, the fabricated wheel being 26ft in diameter at the rope tread. The mechanical parts were made at the Fraser & Chalmers Engineering Works.

An association has been formed between the General Electric Co., Ltd., and Simon-Carves, Ltd., for joint work on atomic energy projects. Extensive laboratories have been built and a research programme covering future reactors as well as those at present being designed is well under way. The design of the first station is in an advanced state and will be completed by the latter half of this year.

All the electrical equipment was designed and manufactured at the Witton Works for a new 74in by $\frac{3}{8}$in cold cut-up line now in full production at the Margam Works of the Steel Company of Wales. This is designed to cut strips from 20 ton coils automatically into lengths varying from 4ft to 36ft and to pile the cut lengths. Other orders in hand for electrical equipment for steel works are for the Steel Company of Wales, John Summers & Sons, Ltd., and several Australian works.

Increases have also taken place in the last twelve months in electrical equipment orders for overseas textile mills including twenty-seven motors totalling more than 5,200 h.p. for jute mills in Calcutta.

The British Railways modernization programme has led to the ordering from the General Electric Co., Ltd., of the power equipments for ten main-line mixed traffic and ten branch-line locomotives to be built by the North

British Railways standard 350 h.p. diesel-electric shunter with G.E.C. electric equipment

British Locomotive Co., Ltd. During the year fifteen British Railways standard 350 h.p. diesel-electric shunting locomotives with General Electric Co. power equipments went into service and work has proceeded on the electrical equipments for 32 four-coach 1,500V d.c. train units for the forthcoming Liverpool Street/Southend service. Overseas, considerable contracts were received in connection with Lisbon Metropolitano, Portugal's first underground railway. These orders covered transformers, rectifiers, switchgear, ventilating and pumping systems for tunnels, cables and lighting, and ventilation.

Diesel-electric propulsion equipment is now in hand for a new 800 ton research ship and contracts in hand for ship lighting include an installation for the *Empress of Britain* which will have more than two miles of "Osram" cold cathode tubing. In the air the galley of the first Britannia long-range propeller-turbine aircraft has been equipped with G.E.C. cooking and water heating appliances.

For agricultural work a multi-purpose crop dryer has been developed from the work of the E.R.A., and other introductions are a new plant irradiator to give greater coverage and an inexpensive greenhouse heater.

In the instrument field accelerometers and strain gauges using the piezo-electric properties of barium titanate have been developed. These are used to measure transient accelerations up to 1,000g at frequencies from 20 c/s to 20 kc/s. The electro-mechanical transducer system has proved particularly applicable to the measurement of turbine expansion characteristics.

During the year a number of radio links for television have been installed, operating in the 2,000 Mc/s band, and other contracts received cover television links in Canada and Switzerland.

Point contact germanium diodes have been improved in temperature performance and can now be used in temperatures up to 70 deg C. An experimental germanium power diode has been successfully operated at mean rectified d.c. currents up to 300 A. An experimental battery portable medium-wave radio receiver incorporating nine junction transistors and one point contact transistor has been constructed.

Research has been going on into the possibilities of mass producing small titanium parts using powder metallurgy methods; and compounds formed between the element silicon and such metals as titanium and tungsten have been the subject of a basic research programme.

Other research work in progress is on the various types of display device for colour television including investigations of the properties of colour phosphors and the preparation of mosaic screens.

Rural Electrification in Europe

SURVEY OF PRESENT DEVELOPMENT

In a series of reports on electrical developments in sparsely populated areas, the United Nations Economic Commission for Europe has compared recent experience and practice of countries within its field of activity.*

Production of electricity is dealt with in a paper on wind-driven generators in parallel with hydro and thermal plants of greater capacity. Wind power is held to be best utilized by many small induction generators rather than fewer large units. Ratings of 100 to 150 kW are to be used in Great Britain, Western Germany and the U.S.S.R. A blade-wheel diameter of 10 metres is required to give 5 kW with a wind velocity of 8 metres/sec. Where the average velocity is below 4 metres/sec more kWh may be taken from the network than are sent out. At 10 metres/sec, obtainable only in favourable localities, 500 kWh/annum/sq metre of blade area can be expected.

Rate of expansion of rural networks is examined in a second paper, which shows that despite different degrees of electrification, varying from 100 to 4,500 kWh/annum/head of population, yearly load growth is generally 6 to 7 per cent in all countries. This applies also to rural areas. In those of backward electrical development this means an increase in the number of consumers as against an increase in the number of kWh taken by each in more highly developed countries.

Distribution Voltages

Primary distribution voltages generally lie between 5 and 25 kV. The latter is regarded as the upper limit desirable, owing to high cost and unreliability of small transformers designed to withstand over-voltages. (This aspect was commented on in the *Electrical Review* of 30th December). Primary feeder lengths are up to 40 km for 20 kV and transformer tappings are set at + 4 per cent at the sending end and − 4 per cent at the receiving end. Substation transformers have tap-changers with a normal range of ± 16 per cent. Recently series capacitors have been installed on unusually long lines. An average diameter of about 2,000 metres is served by a single substation on a 380-220 V network. For most farms up to 10 hectares, the load consists of ten to twenty lights, a 3 kW motor and small heating appliances such as irons and blankets, which together use 40 to 50 kWh/hectare. Peak loads are high and have a duration of 500 to 700 hours a year. From 30 to 40 per cent of households in agricultural districts have electric cookers.

Particulars of consumer voltages in different countries are given in a third document which shows that 380-220 V at 50 c/s is by far the most common system. In another report, on voltage regulation, a drop of 5 per cent is stated to be tolerable. Light output of the ordinary lamp falls to 75 per cent and to 60 per cent for drops of 10 and 20 per cent. Time required for a given output of heating apparatus varies as the square of the voltage, cooling time being increased by about 25 per cent for a 10 per cent drop. To prevent increase in temperature of motors at lowered voltages, higher h.p. ratings than necessary are often used, lowering the power factor and hence reducing the voltage on the network. In Sweden 7·5 per cent voltage drop is permissible; in Belgium the percentages are 5 for lighting, 7·5 for heating apparatus and 10 for motors. In the U.S.S.R. voltage variation on rural networks must be within − 10 to + 7·5 per cent. (The allowance in the U.S.A. is 5 per cent from the transformer station to the consumer and 3 per cent to his appliances.)

Voltage drop along a radial line is decreased very little by going to conductor cross-sections larger than 50 mm² for copper and 70 mm² for aluminium. Application of rotating induction regulators to medium voltage networks has been limited owing to their high cost. The alternative of providing additional substations is usually more economical. For improving voltage regulation by 2 or 3 per cent capacitors are usually less expensive than voltage regulators, but a combination of the two with automatic switching according to load conditions is often employed. In the U.S.S.R. capacitors to provide compensation for line reactance are not considered effective because peak loads normally coincide with high power factors.

Protection of rural populations against excess voltage in medium-voltage overhead lines during storms is usually gained through earthing the neutral conductor at a large number of points. With the aid of small spark gaps connected to the phase wires this prevents penetration of excess voltage into buildings.

Opinions differ regarding the value of placing the neutral above the phase wires as a protection against lightning. Some hold (as in the U.K.) that excess voltages due to lightning are so high as to make the position immaterial, and that placing the neutral below provides a good safety measure if phase conductors break.

The neutral conductor (usually having half the cross section of the outers) is earthed at the beginning and end of a line and intermediately, preferably at branching points, e.g., in the U.S.S.R. at 500 to 700 metres and in Belgium, Italy and Switzerland at 300 to 500 metres. With earthing at 150 to 200 metres the probable number of incidents is sharply reduced.

Permitted resistance of neutral conductor earthing differ considerably. In the U.S.S.R. the maximum permitted for the neutral points of transformers over 100 kVA is 5 ohms and for intermediate earths 10 ohms; for smaller transformers the corresponding values are 10 and 30 ohms. In Belgium they are 2 to 10 ohms in all cases, varying with the nature of the ground, in Sweden 10 ohms and in Finland and Italy 20 ohms. The length of 380-220 V radial lines generally does not exceed 1 to 1·5 km. Inhabitants of dwellings have been struck at 2·5 to 3 m from interior conductors indicating a penetration of 1·5 to 2 million V into buildings. Simple earthing at 40 to 50 metres from a house on one side only does not eliminate the risk.

Electricity on the Farm

In addition to the five reports on distribution noted above, there are three on applications of electricity. One of them relates to lighting in hot-houses and hen houses. For controlling plant growth the lamp in most general use is the 450 W high-pressure mercury-vapour lamp, but its chlorophyll content is lower than that of fluorescent lamps. Particulars are given of the kind of lighting, including colour, found most suitable for various purposes and of kWh consumption and costs of equipment in many cases.

Supplementary lighting of henhouses transfers egg laying activity to the winter with an additional yield of about 30 per cent. One 100 W incandescent lamp is used

* "Rural Electrification." Eight documents, obtainable from H.M. Stationery Office, P.O. Box 569, London, S.E.1, at 1s 6d each.

per 100 hens. "Shock" lighting, which aims at stimulating egg laying as an effect of electromagnetic light waves, requires a 2,000 W lamp per 100 hens for a few seconds each day; overall costs are somewhat higher, load factor is much less and results are not essentially different from the continuous lighting method.

Direct heating of hot-houses by electricity is not regarded as economic, except to keep the thermostatically controlled temperature up to, say, 10 deg C in the coldest spells. In Switzerland one undertaking uses a heat pump, the annual cost of which, including interest and depreciation, is 36 per cent less than for a coke-burning plant. Tray heating by bare iron wires at about 25 V, as practised in the U.K. and in France, has the advantage that the low voltage used ensures safety, but the first cost is higher than that of insulated cable, while the absence of protection against corrosion is said to result in excessive wear compared with cables of chrome nickel wire, insulated and lead covered, or as in Switzerland (and in the U.S.A.) with plastic outer casings.

Electrically heated forcing beds, even in the open air, are much more effective than horse manure and are common in the Netherlands and Switzerland. To heat the soil 1 deg C above its surroundings requires about 50 Wh/sq metre/deg C each day.

Information about irrigation by sprinklers was supplied by the U.K., the Netherlands and Italy and Western Germany. In the U.K. 245 million acres are irrigated, of which 20,000 to 50,000 mainly producing vegetables, are dealt with by sprinklers. The oscillatory spray-line type was favoured formerly, but large diameter rotary sprinklers are a successful innovation. The average first cost of sprinkler installations varies between £30 and £100 per acre, portable units being much the cheapest. Annual working costs are £1 to £2/acre/in of water; about 3in of water is distributed in a season in southern and eastern counties and 1in elsewhere. Hot-houses require 30 to 35in per annum. The demand in farming is expected to increase appreciably, especially for sugar beet, potatoes and forage plants; the chief factor limiting expansion is probably lack of water.

In Italy 200,000 hectares out of a total irrigated area of 2·3 million hectares is watered by sprinklers. Permanent and semi-permanent installations number about 1,000 and portable installations 3,800 with an average of 9 kW at 4·8 atm. pressure. The rotary type is the most popular. In Western Germany pumping power is from 0·4 to 1·2 kW/cu metre of water; one hour's operation is equivalent to ½in of rain, necessitating moving the piping and spray nozzles every 1½ hours. "Slow-rain" irrigation, which requires moving of the equipment only every 5 or 6 hours is rapidly coming into favour. In the Netherlands sprinkler irrigation increases yields by 20 to 100 per cent according to the weather and type of soil. Only 1,200 out of 21,400 installations are portable. Average h.p. is 2·5 to deliver 4·5 litres/min at 2·5 atm.

AUSTRALIAN NEWS

From Our Own Correspondent

THE plans of the State Electricity Commission of Victoria to meet the rapidly increasing demand for electricity are being hampered by inability to secure sufficient capital funds, says the Commission's annual report. The latest £2 million loan raised only £1,063,000 from public subscription and capital finance under such circumstances cannot be planned for as long as a year in advance. To keep pace with increasing demands for power, the Commission estimates that it should be spending £30 million a year on new plant.

During the past year revenue from all sources was £26·8 million, an increase of 13 per cent, but at the same time operating expenditure increased by more than 17 per cent to £25·6 million. All major undertakings earned a surplus except the tramway systems in Geelong, Ballarat and Bendigo, on which the combined losses exceeded £233,000. Revenue from electricity sales was £24,838,000; capital expenditure on new works was over £22 million; and total capital assets now exceed £192 million. A 13 per cent increase in electricity sales brought the total to nearly 3,200 million kWh, an increase of 370 million kWh over 1954. The average annual consumption per domestic consumer rose to 1,921 kWh.

Generating plant available during the past year was just able to cope with the exceptionally large increase in electricity requirements, but the absence of reserve plant on many occasions caused concern in maintaining continuity of supply. During the year 114 MW of plant was added to the system, bringing the total installed generator capacity to over 925 MW. Total production at all power stations rose to almost 4,000 million kWh, an increase of about 470 million kWh. (The Commission now generates 99 per cent of all electricity consumed in Victoria.)

Manufacturers of electrical engineering equipment in Australia expect that the industry will continue to operate at a high level of prosperity over the next six months, says the Division of Industrial Development. In almost all sections production continues to increase. Considerable expansion of capacity has taken place in the wire and cable field, but some over-capacity exists and there are strong hopes that imports may be progressively replaced. Despite the competitive nature of the industry at present, all firms regard their future prospects as good.

The transformer industry has enjoyed a prosperous period of late, but competition is steadily becoming keener. Actually Australia is able to produce a large proportion of its requirements of transformers, and only those for higher voltages and capacities need be obtained from overseas. Manufacturers of industrial transformers have increased production and it would seem that their current level of output should be maintained. Demand for power and distribution transformers, because of the increased allocations of Government finance to electricity supply projects, has continued at a high rate. Demand, however, appears to be insufficient to completely occupy all major producers when imports are taken into account. Some local manufacturers claim that they are subject to unfair competition from overseas suppliers who are said to be offering transformers at subsidized prices.

Tightening of hire-purchase finance could shortly have some effect on the demand for fractional h.p. motors. Some manufacturers, however, hope to be able to enter export markets on a competitive basis and are planning volume production to reduce costs. It is generally considered, however, that manufacturers seeking export markets will need to reduce prices by at least one-third to be successful. Outlook is generally stable and in some cases even moderately expansive. Steady increases in output of electric motors during recent years have lessened the share of the market supplied by imports, despite rapid growth in demand. Many Australian manufacturers are now engaged in redesigning and planning for production of motors in accordance with recently issued British Standard Specifications. Most manufacturers are operating at full capacity on a single shift, with some small amount of overtime being worked.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Portable Tool Protection

I HAVE read Mr. R. E. Jennings' article under the above title in the *Electrical Review* of 20th January with considerable interest, but I feel that his comfortable assumption that the standard earth leakage circuit-breaker could be relied upon to operate with the expected potential on the main earth lead, as shown in his Fig. 1, is without practical foundation. It leaves out of account the distortion of the voltage component when fault impedance is present—and it is rarely absent with portable tool faults—and the possibility of short-circuiting the trip coil by the comparatively low impedance main earth connection.

I have come across many earth faults on tools occurring on the brushgear which invariably leaves one field coil in the fault current circuit; this involves a major volt drop down the fault, too little current passing over the main earth connection to blow the fuse or to provide sufficient voltage for quick operation of the circuit-breaker. This leads at best to marginal operation, and at worst to non-operation.

I am of the opinion that complicated equipment of the kind he describes, costing as much as the tool itself, and, an important point, controlling only *one* tool, prices itself out of consideration. The question arises as to whether it is better to advocate the use of B.S. 842 circuit-breakers alone, which stand some chance of being used in the numbers necessary, or the type of device described by Mr. Jennings; this latter is probably a little more efficient than the small circuit-breaker alone, but this signifies nothing if it is not used.

Folkestone. T. C. GILBERT.

Automatic Control Systems

IN his letter in the *Electrical Review*, of 20th January Mr. G. H. Currie is considering the question of compensators from the point of view of one particular type. There are a number of types available to-day and some of these do not include a small heater within the pilot. The extent to which a compensator regulates the flow temperature in accordance with weather conditions varies according to the type of instrument and the position of the pilot.

The broad statement that the flow temperature is varied in accordance with outside temperature is correct without involving a discussion of the multiplicity of characteristics due to different types of compensators.

Wimbledon, S.W.19. J. RUSSELL HICKMOTT.

Lighting Engineers' Salaries

ANOTHER spotlight on the subject of small salaries by "Lighting Engineer" in your issue of 13th January, which was followed by a refutation by Mr. A. E. Iliffe on the 20th, may disclose a third angle.

Illuminating engineering, I agree, entails far greater knowledge and skill than is generally appreciated. If need be, an advanced mathematical exposition can convince us; or, if we are practical men, the ever-changing appearance of our surroundings, until the sun leaves us to find our own way, and glaring headlights from an approaching car remind us of lighting problems still to be solved.

Illuminating engineering service is *not* free of course, as suggested by your previous correspondents. The lighting manufacturer's entire payroll—directors' fees, lighting engineers' salaries, doormen's wages—comes from the pockets of buyers of lighting equipment.

Periodically specifying large numbers of lighting fittings I never refuse, if I can help it, to interview any lighting engineer over 40 years of age, with matured experience. He need not possess a "personality" and he need not ask for an order. He is the type of engineer most likely to arrest, directly or indirectly, drooping sales curves.

When more competitive times arrive this type of man may well be in demand and be attracted by advertisements indicating commensurate salaries in clear figures.

CUSTOMER.

History of the Lightning Conductor

THE birth of Benjamin Franklin two and a half centuries ago this year recalls the early history of the lightning conductor in England of which he was the "father." The third lighthouse on the Eddystone, a masonry structure surmounted by a copper lantern, was completed in 1759 to the plans of John Smeaton, a scientific instrument maker in his time. As the previous lighthouse designed by John Rudyerd was struck by lightning in 1755 and destroyed by fire, Smeaton consulted Franklin regarding the placing of a lightning conductor on his marine tower which rose 93 ft above the foundations and accordingly a rod was fixed in 1760, the first conductor on record in this country.

The first private house in England to be protected from lightning was that of Dr. William Watson, at Payneshill, in 1762; Watson was a correspondent of Franklin in the field of electrical research. In 1769 the Dean and Chapter of St. Paul's Cathedral, London, becoming alarmed by the havoc caused by lightning to churches in London and all over the country, consulted the Royal Society as to the best plan of protecting Wren's masterpiece. Dr. Cannon had been in contact with Benjamin Franklin in connection with this problem.

Franklin and one Benjamin Wilson were on the Society's Committee but these two lightning protection experts were opposed in their views as to whether the air terminal of the conductor should be pointed or blunt. The former advocated points because of their "attractive and draining power", which was correct in the light of subsequent scientific knowledge, while the latter claimed that the rod should be blunt. Franklin's system was adopted and in it he was a century in advance of his age for he directed that the metals of the ball and cross, the lead covering of the great dome and the water pipes should be connected mechanically and electrically with the conductor and all earthed.

Following this the powder magazine at Purfleet and St. James's Palace were protected by pointed rods as devised by Franklin, but on 15th May, 1777, the magazine was struck by lightning and King George III, who had never favoured the pointed rods of the great American, ordered them to be removed. Wilkes, who removed the rod from the magazine, informs us that it was not properly connected when it was put up in the

first place, hence the failure. Franklin was right and a wag wrote at the time: —

"While you, Great George, for knowledge hunt,
and sharp conductors change for blunt,
the nation's out of joint.
Franklin a wiser course pursues,
and all your thunder useless views
by keeping to the point."

The multiple pointed conductor which protects our buildings and other structures today with complete perfection has altered but little in principle since the days of its promoter, the great American statesman-philosopher and electrician.

COLIN JOHNSTON ROBB.

Ballynahinch, Co. Down.

Royal Visit to Nigeria

DURING her tour of Nigeria, accompanied by the Duke of Edinburgh, the Queen is to inspect work in progress on the Oji River power station in Eastern Nigeria and on 10th February she will formally inaugurate the new Ijora "B" station of the Electricity Commission of Nigeria near Lagos.

The site of the Oji River station is about 30 miles from Enugu. Its planned capacity is 10,000 kW, with provision for an ultimate 30,000 kW. The main contracts were placed in 1953 and the first stage of the work is nearing completion. Two 5,000 kW turbo-alternators are being supplied by W.H.Allen & Sons, Ltd., and four boilers by Babcock & Wilcox, Ltd. The consulting electrical and mechanical engineers are Messrs.Preece, Cardew & Rider and the consulting civil engineers Messrs. Coode & Partners. It is anticipated that power will be available to consumers during the early part of this year. Coal for the station will be brought from Hayes Mine, about 18 miles distant, by an overhead ropeway having an ultimate capacity of 100 tons an hour. The station is about 200 miles up-country from Port Harcourt and the boiler and generating plant have been transported by rail and over difficult roads.

Ijora "B" Power Station

For the opening of the Ijora "B" station Her Majesty will arrive by launch at the Electricity Corporation's wharf where the chairman of the Corporation, Mr. J. Houston Angus, M.I.E.E., M.I.Mech.E., Mem.A.I.E.E., and members of the board will be presented. On arrival at the station entrance the Queen will unveil a commemorative tablet, later operating a ceremonial switch in the control room where representatives of the consulting engineers and principal officials of the Corporation will be presented to her.

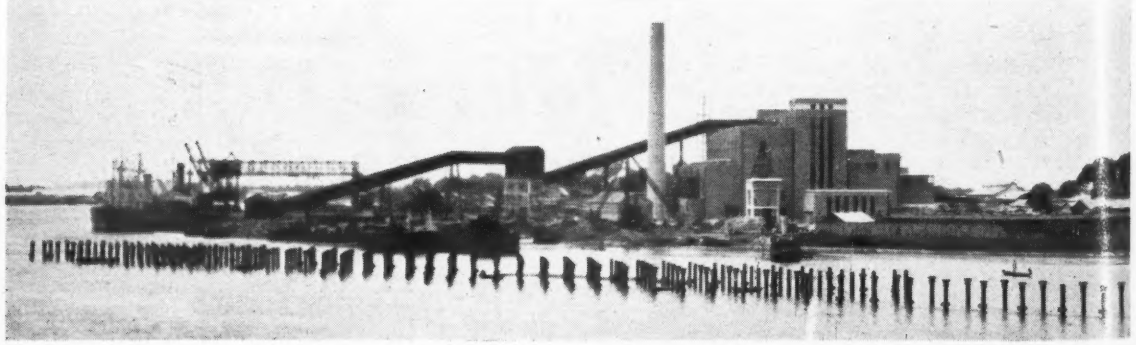
The contracts for the building and plant were placed early in 1951, a few months before the vesting date of the Corporation. The station is built upon reclaimed land over swamp and has presented considerable foundation difficulties. It was found that the subsoil would not support the building as originally designed and the power station is therefore carried upon a reinforced concrete cellular raft of the "buoyant" type; it is claimed that as the weight of the earth excavated to accommodate this raft is approximately equal to the weight of the building and its equipment, the minimum settlement or disturbance will result. Because of the difficult steel situation in the United Kingdom at the time the contract was placed, the steelwork was obtained prefabricated from a Belgian firm and much of the steel was actually rolled in France by the same firm.

The generating plant consists of two 12,500 kW turbo-alternators supplied by the Brush Electrical Engineering Co., Ltd., running at 3,000 r.p.m. and generating at 11 kV, 50 c/s, 0·8 power factor. The contractors for the steam raising plant (four 75,000 lb/hr boilers), coal and ash handling plant and auxiliary services and pipework were the Stirling Boiler Co.,Ltd.; for the transformers, C.A. Parsons & Co., Ltd.; cables, Johnson & Phillips, Ltd.; switchgear, A. Reyrolle & Co., Ltd.; and lighting installation, the Nigerian Electrical Contracting Co., Ltd.

The sub-contractors included Brookhirst Switchgear, Ltd., Johnson & Phillips, Ltd., Chloride Electrical Storage Co., Ltd., Lancashire Dynamo & Crypto, Ltd., Babcock & Wilcox, Ltd., Marryat & Scott, Ltd., James Howden & Co., Ltd., Dewrance & Co., Ltd., Bailey Meters & Controls, Ltd., Cambridge Instrument Co., Ltd., Elliott Bros. (London), Ltd., G. & J. Weir, Ltd., Drysdale & Co., Ltd., Heenan & Froude, Ltd., Igranic Electric Co., Ltd., English Electric Co., Ltd., Standard Telephones & Cables, Ltd., Henry Meadows, Ltd., Broom & Wade, Ltd., and Nife Batteries.

Special floodlighting installations and decorative lighting schemes to the value of £10,000 are being provided by the General Electric Co., Ltd., to illuminate the principal buildings in towns which the Queen and the Duke of Edinburgh will visit during their tour. These include special illuminations for the Royal reception which will be held in the gardens at Government House, Lagos, floodlighting systems at the House of Representatives, the Supreme Court, Ijora "B" power station, and other prominent buildings. Equipment shipped includes 1,072 floodlights of various types; 334 fluorescent fittings with coloured tubes for use in floodlighting; 272 interior decorative lighting fittings, and 294 industrial type fittings for tree lighting.

Ijora "B" power station, near Lagos, which the Queen is to open next week



INDUSTRIAL NEWS

Tariff Inquiries

Notification has been received by the Board of Trade that the Australian Minister for Trade has referred to the Tariff Board for inquiry and report the questions of what rates of import duty should be imposed upon domestic sewing machine motors and controllers and lighting attachments for sewing machines; and what rates shall be imposed on a number of types of a.c. motors and generators and certain kinds of control apparatus. Any United Kingdom interests wishing to tender evidence have to notify the Australian authorities by 11th February and should therefore advise the Board of Trade, Commercial Relations and Export Department, Horse Guards Avenue, London, S.W.1, before that date quoting references C.R.E. 625/56 in respect of sewing machine motors and C.R.E. 681/56 in respect of the other equipment mentioned.

The New Zealand Board of Trade proposes to hold inquiries in April into the rates of duty upon (a) certain switchboards, fuseboards, control apparatus, switches, etc., and upon (b) carpet sweepers and floor polishers with revolving brushes or mops. Statements of evidence concerning (a) have to be submitted by 3rd April and (b) by 27th March. United Kingdom interests proposing to tender evidence are asked to notify the Commercial Relations and Export Department of the Board of Trade.

Plant for Bolivia

Against strong foreign competition Brush Export, Ltd., Loughborough (a subsidiary of the Brush Group, Ltd.), has secured a contract valued at £140,000 for extensions to the existing diesel power plant at Cochabamba, Bolivia. Tenders were received from the United States, Germany, Japan, France and other countries. Cochabamba, the second largest city in Bolivia, has a population of more than 100,000 people and lies 8,600 ft above sea level in the Cordillera de los Andes.

Three National B4AU8 type, pressure-charged, vertical diesel engines, each developing 1,650 b.h.p. (site rating) at 333 r.p.m. coupled to Brush 1,150 kW three-phase, 50 c/s alternators, generating at 10 kV, are to be supplied. The air starting equipment comprises both motor-driven and engine-driven compressors and the water-cooling system consists of heat exchangers, natural draught cooling towers, and water storage tanks. Fuel storage and transfer equipment, together with a lubricating oil centrifuge are also being supplied.

The h.v. switchgear is of the Brush VAs flush-fronted type and has a breaking capacity of 250 MVA at 10 kV. The layout, supply and installation of the equipment, as well as the complete cabling within the power station will be carried out by the general engineering division of Brush Export, Ltd., which is also responsible for supplying a 15-ton engine-room crane, manufactured by Herbert Morris, Ltd., Loughborough. The engines, which are being supplied by the National Gas and Oil Engine Co., Ltd. (a member of the Brush Group) have been designed to run in parallel with two existing diesel sets of American manufacture.

Lamp Price Reductions

The Electric Lamp Manufacturers' Association announces that from 24th January the list price of the following general lighting service lamps of its member companies have been reduced:—200 W pearl (200-260 V), from 4s 3d to 3s 9d; 200 W (200-260 V) inside silica coated, from 4s 9d to 4s 3d. These prices are excluding purchase tax. The list price of the 200 W clear g.l.s. lamps remains unchanged.

Thorn Electrical Industries, Ltd., announces a new "Atlas" and "Ekco" 200 W general lighting service lamp in the 200/260 V range. This new lamp is manufactured in an 80 mm diameter envelope, 10 mm smaller than the original diameter for this particular rating. Both clear and pearl lamps of this rating are to be marketed at a list price of 3s 9d plus 9½d purchase tax. The new lamp is also available in the "White" range at 4s 3d plus 10½d tax. 200 W lamps in the previous size will continue to be available, at the reduced prices mentioned above. The company states that to assist in the stabilization of price levels there will be no increase in the prices of "Atlas" and "Ekco" tungsten filament lamps and fluorescent tubes during the next six months.

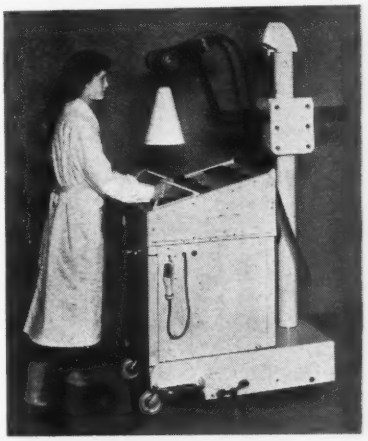
Philips Electrical, Ltd., also announce similar reductions in the prices of their 200 W pearl and silica-coated lamps.

International Mechanical Engineering Congress

The sixth International Mechanical Engineering Congress is to be held in Paris from 4th to 9th June next. As was the case with each of the first five congresses held in 1948, 1949, 1950, 1952 and 1953, together with the conversations held at Stresa in 1954, this Congress is for the purpose of exchanging views as widely as possible on an important technical subject of interest to every branch of the mechanical industry. The theme adopted this year is "Surface treatment for the improvement of mechanical properties and for protection against corrosion." It is hoped that it will attract the greatest possible number of technicians from each country. Indeed it is of immediate concern, both to manufacturers of machinery and those producing consumer goods. In order to facilitate discussion the theme has been divided into eight sections corresponding to eight working sessions of the Congress. The deliberations of each of these sessions will take place under chairmen chosen by the associations organizing the Congress. The organizers for this country are the British Engineers' Association, 32, Victoria Street, London, S.W.1, and the address of the permanent secretariat is 11, Avenue Hoche, Paris (VIII).

Mobile X-Ray Units

A new mobile diagnostic X-ray unit has been specially designed by Newton Victor, Ltd., for rapid radiography of non-ambulant patients. The high



Mobile diagnostic X-ray unit

power output of the unit makes it particularly suitable for bedside radiography of the difficult case.

It is manufactured in two models: one has an output of 100 mA at 90 kVp, the other an output of 60 mA at 90 kVp.

The larger model is fitted with a single focus rotating anode tube, and the smaller one with a single focus stationary anode tube.

An oil immersed h.t. transformer and the tube filament heating transformer are contained in the sheet steel compartment below the control desk and the shockproof cables to the X-ray tube are plugged into receptacles mounted on the transformer cover plates. The control panel contains all the necessary instruments, including a kVp selector

in steps of 5 kVp and mA selector with a coloured signal dial correlating with the kVp selector dial.

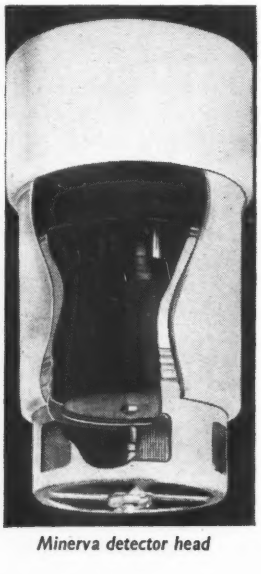
In both units, an oil immersed rotating anode tube unit is supported in a gimbal ring mounting incorporating, in the case of the larger unit, an MX 245 single focus X-ray tube having a nominal projected focal area of 1 sq mm. The stator is automatically energized when the main switch is placed in the "on" position. A delay relay is fitted to prevent exposure being made before the rotor has reached full speed. The smaller unit incorporates an NVD 134 single focus X-ray tube having a nominal projected focal area of 3·5 sq mm.

The tubestand consists of a vertical column of round section supported at the base in a bearing assembly of adequate size and strength to ensure rigidity, with a smooth and easy rotational movement.

Ionization Chamber Smoke Detection

A well produced booklet has recently been published by the Minerva Detector Co., Ltd., Red Lion Street, Richmond, Surrey, to illustrate the principle of their fire detection and control units which have been widely approved by insurance and underwriting organizations.

The detectors are mounted on ceilings in the usual way and are responsive not to temperature but to combustion products such as smoke, a greatly accelerated alarm being thus obtained. The sensitive element is an ionisation chamber in which the air is rendered conducting by the alpha particles emitted from a small quantity of radioactive compound having a theoretical life of 1,000 years. The entry of smoke or similar products of combustion into this chamber radically alters the electrical characteristics of the ionised air, affecting a normally balanced circuit and resulting in an electrical output which is used in conjunction with a control unit to operate an alarm or actuate automatic fire extinguishing equipment.



Minerva detector head

The heart of the operating circuit is a cold cathode gas-filled valve of original design inoperative until triggered by the rise in voltage across the ionisation chamber following the entry of smoke. The tube then passes a current of about 10 mA. The detectors can wired in groups, each group being connected to a separate warning lamp on an indicator panel, the ordinary a.c. mains supply being used.

Colliery Plant Order

The General Electric Co., Ltd., has received an order from Simon-Carves, Ltd., for two 8,000 kW double pass-out condensing turbo-alternators. Installation of these sets in the carbonization plant will form part of the modernization which the National Coal Board is carrying out at Cwm Colliery in South Wales. Inlet steam conditions of this single-cylinder turbine are 400 lb/sq in, 800 deg F, and the exhaust is into a vacuum of 28·0in Hg. The pass-out steam pressures are 130 lb/sq in and 25 lb/sq in. The maximum quantities of steam which may be passed to process are 27,480 lb/hr at the first pass-out stage, and 25,590 lb/hr at the second pass-out stage.

Each of the 3,000 r.p.m. alternators will have an output of 8,000 kW at 11 kV, 0·8 power factor, and will draw its field supply from a main exciter nominally rated at 55 kW. The armature of this exciter and that of the associated pilot exciter will be mounted on a common shaft which will be flexibly coupled to the alternator rotor. The main alternator ventilation system will consist of a closed air circuit including a Heenan & Froude air cooler capable of cooling 20,000 cu ft of air per minute to a maximum temperature of 95 deg F. The cooling air for the totally enclosed sliprings will be drawn from the exciter ventilation system.

Sir Montague Hughman Trust

Sir Montague Hughman, who was chairman of W. T. Henley's Telegraph Works Co., Ltd., for twenty years from 1933 to 1953, has constituted a Trust in the sum of £10,000, the income from which is to be devoted to the relief of necessitous and deserving persons, particularly Henley employees and others as specified in the deed. The management of the Trust is vested in the following four trustees: Mr. S. J. Beaney, Mr. W. J. H. Seager, Mr. J. C. E. Hawke, and Miss G. M. Barefoot.

Pressed Steel Tanks

From Braithwaite & Co. Structural, Ltd., "The Moorings," Church Road, Great Bookham, Surrey, we have received a well-produced loose-leaf brochure illustrating and describing pressed steel tanks produced by the company for a variety of undertakings. Of particular interest is the section dealing with tanks supplied to power stations at home and overseas for the storage of condensate, boiler feed water, reserve feed water, etc.

Lamp Price List in Welsh

The first electric lamp price list in Welsh is being circulated in North Wales. Advertising "Mazda" lamps, its cover is decorated with the traditional Welsh figure of the female harpist. The price list is being distributed from the Chester office of the British Thomson-Houston Co.

Cover of the "Mazda" Welsh price list

Electricity Boards' Sales Staffs Conference

Electricity and smokeless zones is one of the subjects to be dealt with at the E.D.A. annual conference of Electricity Boards' sales staffs to be held in London from Tuesday, 10th April, to Friday, 13th April. The sessions on the first three days will be held at the Caxton Hall, Westminster, and the meeting on the fourth day will be in the Connaught Rooms, Great Queen Street, W.C.2. Last year's conference was attended by about 700 representatives of the various Electricity Boards in the United Kingdom.

The provisional programme provides for an opening address by Mr. J. Eccles, deputy chairman, Central Electricity Authority. On Tuesday afternoon, Mr. J. Gogan, chief commercial officer, South of Scotland Electricity Board, will speak on "Better Lighting in Commercial and Industrial Buildings by Illuminated Ceilings." In the evening there will be a programme of E.D.A. films. "Organizing to Meet Competition," will be the subject of a paper by Mr. W. G. H. Chilvers, assistant chief commercial officer, North Western Electricity Board, on Wednesday morning. In the afternoon Mr. P. Honey (E.D.A.), will speak on "Electricity and Smokeless Zones."

Thursday morning's session will be devoted to the subject of "Planning the Service Centre," when the speakers will be Mr. E. E. Somake (staff architect, Dolcis Shoe Co.), Mr. A. H. Olson (managing director, Courtney Pope (Electrical), Ltd.), and Mr. K. C. White (manager, Display Lighting Division, Courtney, Pope (Electrical), Ltd.). On Thursday afternoon Mr. L. Landon Goodman (E.D.A.), will speak on "Focus on Industry: Automation." There will be a general discussion in the Connaught Rooms on Friday morning, followed by the conference luncheon.

British Refrigeration Association

The British Refrigeration Association announces that arrangements are being made for a luncheon at the Connaught Rooms, Great Queen Street, London, W.C.2, on Friday, 16th March. Mr. H. Nicholls, Joint Parliamentary Secretary to the Ministry of Agriculture, Fisheries and Food has accepted an invitation to attend.

Heating and Ventilating Exhibition

The next exhibition at the industrial showroom of the Midlands Electricity Board at Chester Street, Aston, Birmingham, will be "Heating and Ventilating," which will be held in conjunction with the General Electric Co., Ltd., from 13th to 24th February. The display will include floor heating systems.

Theft!

"Diamond H" Switches, Ltd., informs us that it recently sustained a severe loss of raw materials by burglary. The materials are phosphor bronze strip, beryllium copper strip and copper strip with silver inlay, all in coil. The company asks anyone who receives unusual offers of such metals to telephone them immediately (telephone: Chiswick 6444).

Motor Production in Australia

The accompanying table, based on data supplied by the Commonwealth Bureau of Statistics, analyses the production of electric motors in Australia in 1953-54. Because many of the motors manufactured are incorporated by the makers in appliances such as refrigerators, washing machines, mixing machines, etc., the total values of the motors in each group are not available. The statement shows separately those motors made and used in the works where they are produced, and the number and value of those made for sale or added to stocks.

AUSTRALIAN ELECTRIC MOTOR PRODUCTION IN 1953-54

H.P.	Made and used in works	Made for sale or added to stocks	
	Quantity	Quantity	Selling value at works excluding delivery costs and charges
Up to and incl. ¼	529,721	70,372	£561,772
Over ¼ up to ½	111 549	75,355	£692,928
Over ½ up to ¾	65,579	30,686	£307,794
Over ¾ up to 1	9,605	26,029	£340,728
Over 1 and under 1½	—	6,812	£131,328
1½ and under 2½	225	23,104	£505 567
2½ and under 5	247	9,229	£54,410
5 and under 10	36	5,334	£199,818
10 and under 50	101	4,609	£493,210
50 and over	—	566	£238,983
Total	717,063	252,096	£3,526.538

Trade Announcements

The main stores and trade counter of the **Jeary Electrical Co., Ltd.**, are now at 132-134, East Road, London, N.1 (telephone: Clerkenwell 4141). The registered office remains at 5, Lamb's Buildings, London, E.C.1.

The **London Electric Wire Co.** and its associates, **Frederick Smith & Co.**, the **Liverpool Electric Cable Co., Ltd.**, and the **Vactite Wire Co., Ltd.**, announce the opening of new London branch premises at Lewcos House, 57/61, Regency Street, S.W.1 (telephone: Tate Gallery 8611).

Two new sales representatives have joined the Domestic Department of **Sunvic Controls, Ltd.** They are Mr. J. N. Brock who will cover the Merseyside & North Wales and North Western Electricity Boards, and Mr. H. Gardner, who will cover the Midlands and East Midlands Electricity Boards.

The Liverpool district office of the **British Thomson-Houston Co., Ltd.**, is now at 18, Hepworth Chambers, Church Street, Liverpool, 1 (telephone: Royal 4391). The office of the Lamp and Lighting Department at Liverpool remains at 27/29, Stanley Street, but the telephone number is changed to Central 4371.

Mr. E. Wreford has been appointed to represent **Belling and Co., Ltd.**, in South Wales.

Allen West in Rhodesia

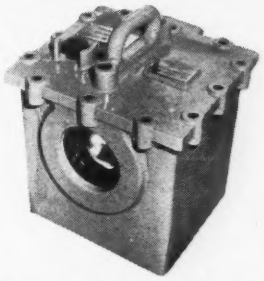
A new Allen West company has been formed in Rhodesia with the title of Allenwest Rhod. (Pvt), Ltd. The registered office will be at 32, Gordon Avenue, Salisbury, with branches at Bulawayo and N'Dola. The new company commenced operations on 1st February.

Radio Sarawak V.H.F. Link

Radio Sarawak, the first regular broadcasting service to be established in British Borneo, has had to overcome many difficulties since it began operating in June, 1954, and perhaps none has been greater than the almost complete lack of landline facilities for relaying programmes. This difficulty has been solved by using a high fidelity v.h.f. radio link. The equipment, which was supplied by Automatic Telephone & Electric Co., Ltd., provides full stand-by facilities for the broadcast channel, as well as an engineering control circuit. This novel application of a v.h.f. link has proved so successful that it is hoped in the future to fit a special vehicle with mobile equipment so that live outside broadcasts will be possible from remote communities throughout the territory.

Flameproof Electronic Flash Unit

Because of the necessary restrictions on the use of supplementary lighting (particularly flash), photography in coal mines has been seriously restricted. In conjunction with the National Coal Board, Ernest Turner Electrical Instruments, Ltd., of High Wycombe, have developed a flameproof electronic flash discharge unit which has been certified as intrinsically safe and flameproof by the Ministry of Fuel and Power. The first experimental pictures taken underground with this equipment have been



Flameproof electronic flash unit for photography in mines

successfully produced by the staff photographer of *Coal*.

In conventional apparatus of this type the electrical energy applied to the shutter synchronizing contacts—small as it is—represents a quite unacceptable risk of ignition. A special non-inductive triggering circuit has been developed in which the total applied energy is many times less than the known maximum safe value. Still further precautions are included to ensure that the total energy in the external circuit cannot approach a potentially dangerous level, even in the event of as many as three internal faults—including mechanical damage to major components—occurring simultaneously. In normal circumstances the possibility of any one of these failures is remote.

The only external connection is made by a standard plug and socket to the synchronizing contacts. The complete apparatus is contained in a cast aluminium-silicon housing designed as a flameproof enclosure and exempted from the restriction placed on the use of aluminium alloys at the coalface. Where additional illumination or special lighting effects are required, a number of identical units can be interconnected by one lead for simultaneous operation. The unit is also suitable for use in petroleum refineries.

OVERSEAS ELECTRICAL TRADE

New High Peak in Exports in 1955

THE publication of the December figures of exports from this country confirms what had become obvious in the closing months of the year, that electrical exports for the year would be considerably higher than in 1954, and in spite of temporary setbacks caused by the railway and dock strikes, the value surpassed that of the previous peak year of 1952 when the total was £183·2 million. For the twelve months ended December last the total value of exports shown under the heading of "Electric machinery, apparatus and appliances" in the Board of Trade returns was £191·9 million, an advance of £21·7 million on the total for 1954 of £170·2 million.

In Table I we show the exports for December, with the total values for the year, compared with those for 1954. From these figures it will be seen that practically all classes of goods shared in the increase, the most spectacular advance being, perhaps, in electric wires and cables, which after falling in 1954, made a good recovery last year, the value rising from £19·4 million in 1954 to £27·7 million last year. India, whose reduced purchases of cable were largely responsible for the fall in exports in 1954, was once again the principal buyer with a value of £3,927,384. Exports of radio, television and associated equipment also showed a notable advance (£26 million to £28·2 million).

South Africa succeeded Australia as the chief importer of British generating plant and motors with a value of £3,320,276 (against £3,056,091 in 1954); Australia, however, followed closely with total imports of £3,228,091 (£3,416,866). Other important purchasers were Canada, £2,266,094 (£1,794,021), India, £2,224,186 (£2,239,547) and New Zealand, £2,175,795 (£1,691,664). Outside the Commonwealth countries, the chief importers were the Netherlands, with a value of £983,081 (£1,180,995) and the Soviet Union, £981,093 (£1,821,741).

TABLE I.—ELECTRICAL EXPORTS

Class	December 1955	Year 1954	Year 1955
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	102,696	1,231,308	1,397,435
Ditto, 10 to 65 kW	60,109	1,753,408	1,497,753
Ditto, 65 to 200 kW	130,313	938,477	1,452,335
Ditto, over 200 kW	206,462	4,137,439	4,900,692
Spark ignition engine driven	22,144	191,807	263,557
Steam turbine driven	12,038	1,349,596	1,360,437
Other prime mover driven	13,184	1,132,833	690,792
Generators, not exceeding 200 kW	79,423	2,307,654	1,526,138
Ditto, over 200 kW	283,906		1,447,553
Parts of generators	305,680	4,593,418	4,991,495
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ½ h.p.	213,812	2,200,890	2,546,114
Over ½ but under 1 h.p.	82,416	631,196	811,391
1 h.p. to 250 h.p.	468,766	4,529,501	4,754,074
Over 250 h.p.	80,733	1,480,795	927,672
Railway, tramway and trolley-bus motors complete and parts of all motors	156,430	1,686,037	1,895,997
Motor starting and controlling gear	201,055	2,282,000	2,396,816
	2,419,137	30,446,359	32,860,251
Converting machinery	39,546	500,892	560,344
Mercury-arc rectifiers	75,276	638,909	843,227
Transformers for lighting, heating and power (incl. coils)	1,114,683	10,743,097	11,096,060
Switchgear and switchboards (not telegraph or telephone), up to 200 A and 660 V	250,204	15,240,250	3,185,253
Ditto, other	1,072,962		12,188,338
	2,552,671	27,123,148	27,873,222
Primary batteries:			
Lighting	53,800	789,103	869,374
Radio	204,976	1,776,247	2,152,758
Other	36,031	535,055	456,523
Parts (excl. carbons)	47,128	596,843	420,621
Lamps:			
Filament, exceeding 24 V	103,104	927,837	1,101,499
Ditto, under 24 V	36,343	361,848	379,321
Discharge lamps, fluorescent tubes, etc.	90,761	700,524	866,879
Other lamps	13,595	249,247	169,880
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury arc rectifiers), photo-electric cells, stabilizing and cold cathode valves, magnetrons, klystrons*	21,119	—	238,731
Cathode-ray tubes	13,183	140,124	131,619
Other valves (not X-ray)†	192,179	1,970,495	2,180,363
Radio and television transmitters	105,170	676,486	769,126
Commercial radio and radar equipment	1,004,813	11,721,000	12,076,790
Domestic radio receivers, mains	120,365	1,921,789	1,867,615
Ditto, battery	94,193	650,460	866,802
Ditto, other (incl. car)	21,220	169,926	233,129
Radiograms	21,258	433,369	510,267
Television sets	99,060	450,299	491,693
Public address equipment	86,129	718,670	956,094
Sound reproducing app. n.e.s.	33,950	289,328	329,666
Components and parts, n.e.s., incl. parts of valves and c.r. tubes	661,261	6,853,002	7,556,352
	2,473,900	25,994,948	28,208,247
Telegraph and telephone installations	652,873	7,020,645	7,788,489
Telephone instruments, separately consigned	51,801	1,168,916	1,131,833
Telegraph and telephone parts	578,004	5,416,974	5,883,577
Line apparatus for long distance commun.	127,676	1,526,738	1,016,971
	1,410,354	15,133,273	15,820,870

Class	December 1955	Year 1954	Year 1955
	£	£	£
Cookers	81,205	1,000,436	1,304,308
Toasters	17,661	251,731	366,056
Other cooking apparatus	31,544	404,436	373,502
Parts and accessories	73,960	567,444	868,813
Space heating appliances	39,084	415,627	429,661
Water heating appliances	33,344	298,122	409,354
Other heating appliances	38,652	362,720	347,675
Parts and accessories	65,173	611,813	872,116
Irons	107,605	820,039	1,266,255
Arc welding equipment, a.c.	36,126	376,915	419,209
Ditto, d.c.	50,349	535,596	390,983
Resistance welding equipment	18,175	188,362	222,884
Electric furnace plant*	77,930	—	693,495
Magnetos, ignition	27,852	164,641	206,830
Sparking plugs	196,468	1,725,875	1,913,292
Elec. appliances for aeroplanes, n.e.s.	209,332	2,084,749	2,279,383
Ditto, for motor vehicles, n.e.s.	365,000	2,949,580	3,800,931
Ditto, for cycles, n.e.s.	69,810	841,690	847,500
Signalling app. (incl. traffic signals)	129,614	582,828	687,513
Industrial radio-frequency equipment	9,981	258,732	177,928
Bell app. (not telegraphic or telephonic)	7,140	101,896	103,086
Instruments, commercial	179,676	1,756,949	1,801,494
House service meters (not prepayment)	153,058	1,339,084	1,337,978
Ditto, prepayment and parts of all house service meters	22,762	181,355	283,427
Electro-medical apparatus (not X-ray)	50,887	533,587	598,139
X-ray apparatus (excl. tubes and valves)	78,295	579,060	774,065
Vacuum tubes	29,197	214,737	271,029
Desk fans	28,611	358,849	307,257
Ceiling fans	54,251	998,821	959,937
Parts of fans*	4,177	—	69,212
Vacuum cleaners	159,830	2,029,941	1,575,401
Floor polishers	106,739	1,165,146	1,168,199
Food mixers	39,707	628,784	631,383
Hair clippers and dry shavers	134,636	1,238,570	1,152,437
Other portable appliances	26,010	374,011	475,797
Parts	120,381	898,546	1,077,582
Portable elec. tools (not saws) and parts	221,482	1,913,324	2,312,328
Cables and wires:			
Telegraph and telephone, submarine	25,141	770,910	861,844
Ditto, other	658,537	3,796,120	6,392,762
Cotton, silk or art. silk insulated	53,652	438,880	590,706
Enamel, glass or asbestos insulated	103,122	873,868	930,315
Paper insulated	1,074,847	6,128,474	9,717,977
Rubber insulated	512,157	4,646,181	5,746,255
Thermoplastic insulated*	89,682	—	1,044,354
Other	220,415	2,736,456	2,466,649
	2,737,553	19,390,889	27,750,862
Accumulators for motor vehicles	159,300	1,752,055	1,9[illegible]2,510
Ditto, traction	20,212	277,818	2[illegible]4,186
Ditto, radio and other portable	80,727	667,086	7[illegible]5,574
Ditto, other	95,912	497,604	4[illegible]4,014
Parts and accessories	87,130	736,081	1,1[illegible]0,026
Elec. porcelain, etc. (incl. insulators)	66,001	949,396	1,0[illegible]6,101
Insulating cloth and tape	88,289	622,029	7[illegible]1,069
Other insulating material	106,581	903,580	1,1[illegible]2,421
Permanent magnets	38,010	513,599	5[illegible]7,406
Radio, telegraph and telephone testing equipment, n.e.s.	50,946	424,718	4[illegible]5,694
Scientific elec. instruments (not telegraphic or telephonic)	282,083	2,598,154	2,9[illegible]9,084
Electrical machinery, n.e.s.	87,294	1,511,984	1,2[illegible]4,754
Electrical apparatus and appliances, n.e.s.	693,943	5,931,129	7,4[illegible]9,808
TOTAL	17,131,485	170,164,550	191,879,393

* Not separately distinguished before 1955.

† The 1954 and 1955 figures are not completely comparable.

TABLE II.—DISTRIBUTION OF EXPORTS OF ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES

Country	Dec. 1955	Year ended 31st December 1953	1954	1955	Country	Dec. 1955	Year ended 31st December 1953	1954	1955
	£	£	£	£		£	£	£	£
Channel Islands	111,353	475,803	663,457	876,148	Netherlands	586,071	5,070,930	6,448,047	6,786,420
Gibraltar	10,642	220,998	192,534	188,000	Belgium	329,399	3,493,858	2,980,514	2,989,480
Malta and Gozo	46,091	322,912	634 181	548,137	France	234,687	3,096,830	3,144,887	3,103,136
Cyprus	155,626	605,509	771,417	1,215,006	Switzerland	70,927	849,403	1,065,699	1,093,953
Sierra Leone	19,918	346,472	265,326	249,962	Portugal	98,351	1,683,162	2,032,510	2,157,411
Gold Coast	136,991	1,193,149	1,259,041	1,785,215	Spain	217,158	2,920,889	2,805,647	1,710,751
Nigeria	272,361	2,256,824	1,834,569	3,124,437	Italy	289,478	2,362,433	2,674,675	2,918,699
Union of South Africa	1,600,179	19,838,186	17,942,216	17,986,267	Austria	31,533	684,230	588,819	524,484
Rhodesia and Nyasaland	754,312	4,048,540	3,845,400	5,734,423	Yugoslavia	45,223	663,958	1,041,338	670,862
Tanganyika	59,618	613,553	617,939	1,029,795	Greece	148,054	912,668	907,581	1,282,719
Kenya	139,179	2,711,976	1,689,994	2,034,207	Roumania	88	1,077,393	42,281	3,138
Uganda	69,363	848,899	647,903	1,143,325	Turkey	102,983	1,076,976	621,773	1,143,234
Mauritius	12,113	277,983	221,691	329,912	Belgian Congo	27,965	376,559	313,169	318,966
Aden	41,734	1,710,392	826,808	501,476	French Morocco	42,160	276,916	279,771	383,569
Bahrain, Qatar and Trucial Oman	152,686	1,047,308	1,295,224	1,007,767	Portuguese East Africa	28,145	250,596	247,332	246,207
Kuwait	162,091	1,675,203	1,358,848	1,159,497	Syria	70,338	297,038	329,604	396,762
India	1,478,738	18,029,027	14,808,947	16,245,707	Lebanon	32,820	390,572	357,561	411,141
Pakistan	310,144	3,597,106	4,826,814	3,792,596	Israel	61,759	660,773	364 637	498,061
Singapore	277,652	2,887,825	3,139,959	3,735,492	Jordan	43,741	297,735	251,097	429,336
Federation of Malaya	213,251	2,882,382	2,525,634	2,858,832	Egypt	185,236	1,266,005	1,199,572	1,718,811
Ceylon	149,210	1,826,676	1,375,188	1,482,023	Libya	25,671	206,058	113,816	213,313
British North Borneo	15,721	347,115	389,471	237,585	Saudi Arabia	125,966	500,114	568,322	945,121
Hong Kong	355,385	2,205,984	1,806,788	2,195,759	Iraq	52,057	2,368,344	2,464,167	2,349,308
Australia	1,815,041	17,087,387	17,653,169	21,044,366	Iran	28,387	223,780	391,654	840,477
New Zealand	990,950	9,678,592	9,840,080	12,318,252	Burma	149,885	1,294,898	1,615,689	1,811,071
Canada	843,000	8,514,261	8,251,760	8,351,273	Thailand	34,961	1,425,039	1,826,800	1,630,443
Jamaica	108,829	744,442	758,581	1,096,562	Indonesia	52,410	781,835	563,639	422,261
Barbados	19,121	163,926	229,831	238,818	Japan	96,736	808,670	730,032	1,091,335
Trinidad	101,010	958,768	983,990	1,101,628	United States of America	538,658	2,387,824	2,699,359	5,349,984
British Guiana	34,198	350,300	398,131	539,304	Cuba	9,810	202,166	207,288	272,758
Anglo-Egyptian Sudan	57,776	1,173,338	1,090,220	867,064	Mexico	33,213	347,008	370,189	453,591
Other Commonwealth countries	150,590	1,505,081	1,363,621	1,756,930	Colombia	49,617	606,671	1,106,615	902,594
Irish Republic	372,170	3,331,497	3,326,008	4,082,536	Venezuela	148,505	1,845,196	2,117,131	2,425,442
Soviet Union	547,190	1,299,552	2,390,243	3,736,003	Peru	29,094	439,676	348,810	446,010
Finland	148 045	807,347	1,311,412	1,594,644	Chile	22,696	446,780	434,577	311,214
Sweden	400,023	4,167,016	4,267,619	4,155,566	Brazil	70,789	1,189,601	879,799	790,749
Norway	159,465	3,131,823	3,102,645	3,424,005	Uruguay	22,797	401,322	758,438	379,117
Iceland	15,352	221,047	203,986	161,466	Argentine Republic	125,984	983,964	1,030,041	1,714,077
Denmark	185,386	1,295,474	1,948,376	1,830,635	Other foreign countries	185,627	2,034,113	2,014,636	2,652,756
Poland	1,876	1,008,599	589,650	212,803	Total	17,131,485	172,575,759	170,164,550	191,879,393
Western Germany	188,126	965,504	1,578,363	2,117,209					

The overseas demand for British electrical domestic equipment and apparatus continued to rise, the principal advances being in electric cookers (by £300,000 to £1,304,308) and irons (by over £400,000 to £1,266,255). There was also a substantial increase in the demand for portable electrical power tools exports of which were valued at £2,312,328 (against £1,913,324).

Table II analyses the destinations of exports included in Table I and the accompanying diagram shows the comparative trends each month in 1954 and 1955. In addition to the equipment shown in Table I a number of electrical products are given in other sections of the official returns and the most important of these are included in Table III.

Electrical imports continued to rise, the total value for 1955 being £23·5 million, as compared with £15·9 million

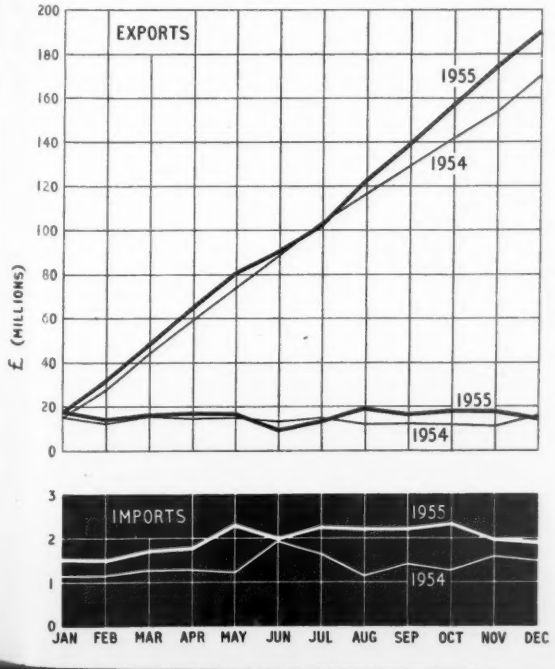


TABLE III.—OTHER ELECTRICAL EXPORTS

Class	December 1955	Year 1954	Year 1955
	£	£	£
Washing machines, electrically operated:			
Not exceeding 150 lb weight	362,514	2,949,551	3,473,945
Over 150 lb	142,286	1,612,450	1,417,423
Parts	59,517	598,075	646,621
Electric conduit tubes and cased tubes	64,308	792,394	647,737
Welding electrodes:			
Ferrous	93,620	831,081	980,825
Non-ferrous	25,007	267,771	320,032
Electric locomotives	186,425	1,902,842	2,187,520
Diesel locomotives with electrical transmission	597,800	4,134,381	6,456,643
Electric lighting appliances (excluding vacuum tubes and lamp bulbs), accessories and fittings, and parts, n.e.s.	424,412	4,713,599	5,109,517

TABLE IV.—ELECTRICAL IMPORTS

Class	1954	1955
	£	£
Generators, including parts	879,485	528,258
Motors, including parts	368,790	821,899
Convertors, mercury arc rectifiers, transformers, switchgear and switchboards (not telegraph or telephone)	711,807	1,005,973
Valves, electronic, excluding X-ray valves (whether separately consigned or with apparatus of which they form a part), complete	1,697,094	2,494,700
Cathode ray tubes, complete	1,640,623	1,173,437
Radio communication and navigational aid equipment (including radar), complete	1,655,507	1,547,998
Other apparatus for telegraphy, telephony, radio, television and radar, including components	2,972,890	7,895,742
Welding machinery other than tube-making (not electrodes)	160,043	232,077
Magnetos, ignition, and electric appliances for aeroplanes, motor vehicles and cycles	1,250,066	1,481,680
Electro-medical apparatus (including X-ray apparatus, tubes and valves)	501,529	700,399
Electric cables, wires, strips and strands, insulated	189,089	318,450
Scientific electrical instruments (not telegraphic or telephonic)	686,255	914,795
Electrical Machinery and appliances n.e.s.	3,246,328	4,393,990
COUNTRY		
Australia	395,876	399,093
Canada	1,704,988	1,482,265
Other Commonwealth countries	921,555	908,506
Irish Republic	473,351	764,040
Sweden	557,610	794,460
Denmark	250,169	395,718
Western Germany	1,898,367	4,456,269
Netherlands	4,748,271	6,047,536
Belgium	282,810	326,875
France	592,987	796,659
Switzerland	673,338	990,467
Italy	160,140	259,845
United States of America	2,641,253	5,073,547
Other foreign countries	658,791	814,118
TOTAL	15,959,506	23,509,398

for 1954. It will be seen from Table IV that radio apparatus accounted for about £13 million, or more than half of the total. Of the principal suppliers, the most significant advances were made by Western Germany, the value of whose imports into this country rose from just under £2 million to £4·4 million, and the United States, who sent us electrical equipment of the value of £5 million (against £2·6 million in 1954). The Netherlands, with a total value of a little over £6 million (against £4·7 million) remained the chief supplier.

Fires and Age of Installations

Risks Through Deterioration Discussed

THE discussion on the I.E.E. Utilization Section paper by Mr. L. Gosland entitled "Age and the Incidence of Fires in Electrical Installations," which was reported in our last issue, was opened by Mr. S. J. Emerson (Factory Department). The experience of his Department, he said, was that deterioration might be evident after 25 years. Many small houses built at the end of the war, however, had installations like bell wiring. Over 70 per cent of the thousand or so fires investigated in the past eight years had been due to flexible cable and not the permanent installation. By abolishing flexible cables and ensuring that, where a cable entered a distribution board, a ceiling rose or a wall plug there was no possibility of leakage and concentrated heating, 25 per cent of the accidents could be avoided.

In the last 25 years there had been fewer than 100 failures of service connections in a total of over 300,000 factories. Earth leakage currents which caused trouble usually exceeded 1 A; if they were less than about 0·5 A fire hazards with fixed installations would probably be eliminated.

Service Cables

Mr. P. M. Hollingsworth (B.I.C.C.) stated that service connections were mainly paper-insulated cable which, apart from accidents, should have a life equal to that of the building. Rubber-insulated cables containing rubber compounds used before the 1930s, which did not contain anti-oxidants, were liable to perish and so become more susceptible to moisture and movement. Modern compounds containing anti-oxidants could also be desirably applied to more recent types of insulation such as p.v.c., while mineral-insulated cable could be regarded as ageless. Some of these materials were fire-resistant in themselves, but that was of less importance than electrical quality and mechanical strength.

Mr. R. A. Marryat (Marryat & Place) referred to early installations as intended primarily for lighting, thus differing from post-war installations. If they had not been altered they might be very much overloaded, and any alterations or extensions had very probably been done by amateurs. Deterioration of flexible cables, especially in premises lacking an adequate number of socket outlets, was often the unascertained cause of fires.

Mr. H. W. Swann said that many technical institutions were training people to take an interest in electrical work, and those people would apply their knowledge. If they could make a circuit work there was a great temptation to do it, especially in view of the present cost of "competent and authorized persons."

Mr. D. I. Lawson suggested that fires due to electrical apparatus were proportional to the amount of energy transmitted, amounting to one fire for every 10 million kWh. With the trebling of the electrical figure over the next 20 years the present figure of 6,000 a year might rise to 18,000. Fires due to wires and cables depended on the age of the installation and varied only slightly with the energy transmitted. At present the aggregate age of the installations in this country was 280 million installation-years. In 20 years the number of installation-years for those installations alone would have increased to 520 million, so that the present level of 2,400 fires a year from this cause might be nearly doubled.

Mr. N. C. Strother-Smith (Fire Protection Assurance Co.) emphasized that a well-maintained old installation might be safer than a badly-maintained new installation, and that if age were dealt with separately other aspects of safety might be overlooked. The placing of wiring and apparatus might be responsible for a large fire or it might limit the fire to negligible proportions. Pressure should be brought to bear on consumers to have their installations tested thoroughly at frequent intervals.

Mr. T. C. Gilbert suggested that an earth-continuity conductor should be treated as a conductor in its own right and not as a haphazard collection of bits of iron, steel or lead. It should be looked on as potentially alive and therefore insulated against extraneous contact. Much more use should be made of synthetic materials in cable insulation and sheathing.

Mr. J. I. Bernard referred to cases where gas and electricity were associated in the same appliance. The stock remedy was to bond the conduit to the gas pipe, but it was his experience that the earth-continuity resistance might be lower through a gas pipe than through almost any electrical earth connection.

Mr. G. E. B. Brunner (Fire Services College) suggested that for a year or two Area Board engineers should attend immediately any premises at which in the opinion of the Fire Service officer an outbreak of fire had an electrical cause, in order to make a systematic check and complete a standard questionnaire.

Mr. G. E. L. Redman, asked why mineral insulation was not more used. It was inorganic and so almost ageless and was impervious to moisture. Thousands of houses now being bought on mortgage by young married couples had very inferior wiring.

Mr. M. Beaumont agreed that an earth-continuity conductor should be properly insulated throughout its entire run, but asked why other, non-metallic, systems were not used, so that if there was a breakdown owing to faulty insulation the fault would be contained within the conduit.

Mr. C. J. Veness, as an installation contractor, felt that if some of the fires were investigated the fault would be found to be due to inferior workmanship, and suggested that the registration of operatives and contractors would go a long way towards solving that problem.

Mr. F. C. Walmsley complained of the tiny spaces left in fittings in which to put the wires and said that for terminations it was necessary to have fingers like knitting-needles to get at the connections. Fittings manufacturers should pay attention to these details.

NEW ELECTRICAL EQUIPMENT

Floor Polisher

Specially designed to cope with the polishing of large floor areas, the new B.9 floor polisher, just announced by ELECTROLUX, LTD., 153-5, Regent Street, London, W.1, replaces the previous B.6 model and incorporates several new features. One of these is the "floating" suspension of the brushes which makes them self-adjusting to floor irregularities. Another is an automatic built-in switch which prevents the polisher from being operated when the handle is upright in the locked position. If the handle is accidentally dropped polishing automatically stops. To release the handle for starting a pedal is incorporated in the hood. The upper cable holder is turnable and a flick of the finger instantly releases the entire cable.

Electrolux B.9 floor polisher

The price of £23, plus £10 1s 10d purchase tax in the United Kingdom, includes a set of hard brushes for spreading the polish, one of soft brushes for polishing, and felt discs for high gloss finishing.

Refrigerators

Electrolux, Ltd., also announce that their family-sized refrigerator L.230, which previously had been produced only in white, is now available in a cream finish. In addition to the cream body it has a turquoise-coloured door frame and door shelves. The price is £41 18s plus £19 purchase tax in the United Kingdom.

Electric Tyre Pump

Designed for the car-owner or bicycle dealer the "Crown" electric tyre pump, manufactured by the MOTOR ELECTRICS CO., Crown Lane, Marlow, Bucks, consists of a single cylinder air compressor coupled to a universal $\frac{1}{10}$ h.p. motor housed under a cover as one complete unit. Output is about $\frac{1}{2}$ cu ft per minute and pressure can be obtained up to 85 lb/sq in; an average car tyre can be inflated, from flat, within 4 minutes.

In addition to a mains operated pump there is also a model suitable for use on 6 or 12V car batteries. It is fitted with a carrying handle and weighs 8lb. The base measures 6½in in diameter and the height is 6in. A dial pressure gauge can also be supplied as an extra. The price is £13 15s.

"Crown" electric tyre pump

Field Ratemeter

A transistorized battery operated instrument has been developed by ERICSSON TELEPHONES, LTD., Beeston, Nottingham, in conjunction with the A.E.R.E. (Harwell) for geological surveying and mapping, prospecting for radio-active ores and for the examination of mine workings. When it is used with a beta probe unit, assay work can be carried out in the field.

The ratemeter employs a junction type transistor and four G.M. tubes. The count rate is indicated on a 50 μA meter calibrated in milli-Röntgens per hour. Five ranges are provided covering count rates of 0 to 25 mR/hr. The accuracy is selected by means of a switch and is either 10 per cent or 2 per cent. Speed of response depends on the accuracy selected. Audible indication of the count rate is available if required.

All power supplies are derived from three 1·5V torch cells, and the beta probe unit obtains its power supplies from the same source.

The complete equipment, which includes ratemeter, probe unit with extension handle, canvas haversack, headphones, sample holders and filling funnel for assay work, tools and spare parts, is contained in a lightweight alloy suitcase, total weight 28 lb.

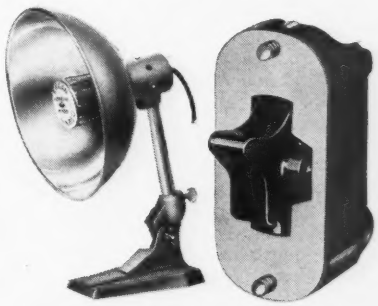
Medical Lamp

The latest addition to the range of infra-red ray appliances manufactured by ERGON ELECTRICAL MANUFACTURING CO., LTD., Vencourt Place, King Street, London, W.6, is the Ergon "Junior" prescription model. Basically it consists of a 10in diameter highly polished aluminium reflector and a combined infra-red and radiant heat generator with a loading of approximately 450W.

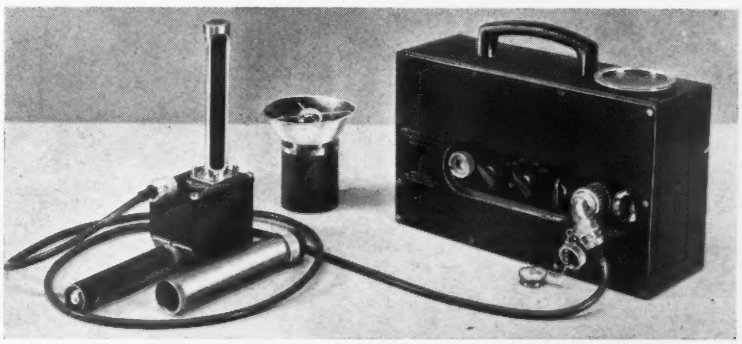
Standard models are suitable for use on 200/250V supply; models for 100/110V can also be obtained. The lamp is priced at £3 17s 6d and can only be sold against a doctor's prescription.

Intermediate Switch

A very compact 5A intermediate switch is now being produced by M.K. ELECTRIC, LTD., Wakefield Street, Edmonton, London, N.18. The new



Left. Ergon "Junior" infra-red medical lamp. Right: M.K. Electric 5A intermediate switch and (below) Ericsson field ratemeter

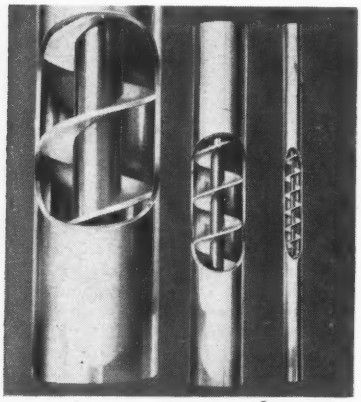


switch is identical in dimensions to the company's one-way and two-way standard "Gridswitch" components and is completely interchangeable with them.

It is possible to use the new switches in standard boxes up to eight-gang units with any combination of one-way and two-way switches. The price, per dozen, is £3 1s 4d (brown) and £3 3s 4d (ivory).

Helical Membrane Cable

A new high-power feeder capable of carrying 20 kW at 100 Mc/s has now been added to the range of helical



The new large helical membrane cable is on the left

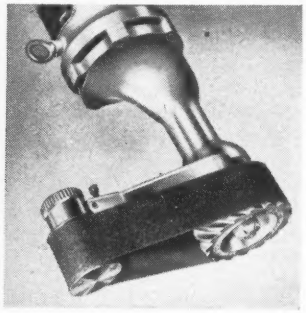
membrane cables manufactured by the TELEGRAPH CONSTRUCTION & MAINTENANCE CO., LTD., Mercury House, Theobalds Road, London, W.C.1. The new cable, known as HM.10.A1, has a diameter of $3\frac{1}{8}$in over the aluminium tube outer conductor, and a characteristic impedance of 50 ohms. Intended for applications such as television transmitter aerial feeders where previously built-up feeders would have been used the new cable gives the advantages of high electrical uniformity with easier and more economical installation.

In common with the six smaller helical membrane types already on the market, in impedances of 50 and 75 ohms, H.M.10.A1 is constructed with a central copper conductor supported within a tubular outer conductor of aluminium by a helical edge-on tape of polythene.

Wolf Sanding Attachment

A new belt sanding attachment has been introduced by WOLF ELECTRIC TOOLS, LTD., Pioneer Works, Hanger Lane, London, W.5. Of robust construction, it has been designed for use in conjunction with the 6in high speed heavy duty grinder, type GQ6. The attachment consists of a patented 4 in diameter by 2 in wide rubber tyred contact wheel and a cast aluminium bracket at the end of which is mounted a steel pulley running on a ball bearing. The abrasive belt is mounted on the steel pulley and is correctly tensioned by means of a spring loaded eccentric, the assembly position being controlled by an adjusting screw.

The bracket is mounted on the end of the GQ6 grinder gearbox in place of the existing wheel guard, and uses the same fixing screws, the rubber tyred contact wheel being fitted on the grinder spindle. This wheel provides a firm but resilient backing for the abrasive belt, and can be used in a similar manner to back stand idlers on bench machines. Also, the slack part of the belt between the contact wheel and pulley makes the attachment



Belt sanding attachment for grinder

extremely suitable for the finishing of convex and concave surfaces. In addition, it is ideal for use on thin gauge material and for the finishing of stainless steel components, giving polish marks running in one direction only.

A selection of abrasive belts is available all of which are suitable for use on materials ranging from cast iron to wood.

Vacuum Cleaner

An inner air sleeve dust bag is incorporated in the new model 420 electric cleaner introduced by the HOTPOINT ELECTRIC APPLIANCE CO., LTD., Crown House, Aldwych, London, W.C.2. This dust bag makes frequent emptying unnecessary and ensures an unobstructed air flow with full suction.

The handle can be angled to reach under furniture and beds without any adjustments; this handle is now finished in grey, as is the base casting, and the bag and flexible are maroon coloured. A height adjustment is fitted to the side wheels and the motor is controlled by a toe-operated switch. A plastic bumper band is incorporated for the protection of furniture.

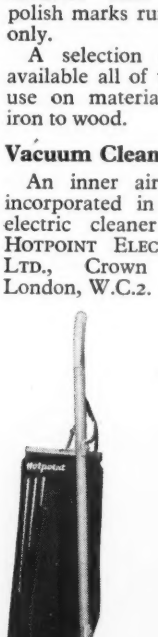
The series wound universal motor is fitted with grease-packed thrust type ball bearings and is suppressed against radio and television interference. Voltage ranges are available for 100/110, 200/220 and 230/250 V a.c. or d.c.

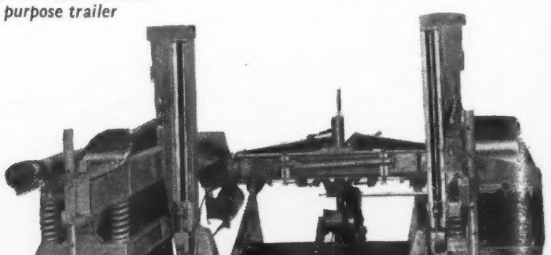
The price is £14 10s plus £6 7s 3d purchase tax in the United Kingdom. Dusting tool attachments are £3 extra plus £1 6s 4d tax.

Dual-Purpose Trailer

RICHARD C. GIBBINS & CO., LTD., Berkley Street, Birmingham, 1, have recently supplied a 4-ton trailer of special design to the order of an Electricity Board. It consists of a Gibbins cable drum trailer, suitable for picking up and transporting drums of cable weighing up to 4 tons but it can be readily adapted to carry transformers, the conversion being made in a few minutes by slinging a detachable platform between the cable drum bearers. The front end of the platform is supported on pin joints anchored to the underside of the front cross member of the trailer chassis. When the cable drum jacks are screwed down, the platform tilts to form a ramp up which the load is drawn by a hand operated winch, mounted on the front of the platform. Once the load is on board, the jacks are operated to raise the platform to the normal position once more. This type of dual purpose trailer should be useful to electricity authorities and cable laying contractors since it gives the equivalent of two specialized self-loading transporters for very much less than double the cost of one.

Left: Hotpoint model 420 vacuum cleaner
Right: The Gibbins dual-purpose trailer





GENERATION AND DEVELOPMENT

Electricity Boards' Sales

Electricity output figures for December and the whole of 1955 were given in our last issue. The accompanying table, which analyses the sales of the twelve Electricity Boards in England and Wales, shows an increase in December of 9·7 per cent, but when corrected for weather conditions and working days (27·56 against 27·44 in December, 1954) the increase was 9·1 per cent.

Electricity Sent Out by Area Boards for their Consumers

Area Board	Totals for December (million kWh)			Twelve Months Totals Ended 31st December		
	1954	1955	Inc. or Dec. %	1954	1955	Inc. or Dec. %
London	635·3	692·2	+ 9·0	6,066·3	6,562·7	+ 8·2
South Eastern	369·1	425·0	+ 15·2	3,644·2	4,013·5	+ 10·1
Southern	446·6	502·9	+ 12·6	4,336·0	4,829·5	+ 11·4
South Western	226·3	252·4	+ 11·5	2,227·2	2,485·0	+ 11·6
Eastern	608·5	675·4	+ 11·0	5,942·9	6,515·2	+ 9·6
East Midlands*	509·6	557·7	+ 9·4	5,086·5	5,610·8	+ 10·3
Midlands*	677·7	736·6	+ 8·7	6,827·1	7,403·9	+ 8·4
South Wales*	369·7	396·1	+ 7·1	3,950·9	4,296·3	+ 8·7
Merseyside & North Wales*	394·3	438·2	+ 11·1	3,918·9	4,415·2	+ 12·7
Yorkshire*	658·9	720·0	+ 9·3	6,632·1	7,288·1	+ 9·9
North Eastern*	382·2	413·7	+ 8·2	3,928·2	4,225·9	+ 7·6
North Western*	736·7	781·3	+ 6·1	7,396·8	7,825·4	+ 5·8
Total all Area Boards	6,014·9	6,591·5	+ 9·6	59,957·1	65,471·5	+ 9·2
Direct Supplies by Central Authority	144·8	165·6	+ 14·4	1,282·1	1,728·6	+ 34·8
Grand Total	6,159·7	6,757·1	+ 9·7	61,239·2	67,200·1	+ 9·7
Mainly Industrial Areas*	3,729·1	4,043·6	+ 8·4	37,740·5	41,065·6	+ 8·8
Mainly Non-Industrial Areas	2,285·8	2,547·9	+ 11·5	22,216·6	24,405·9	+ 9·9

* Those in which industrial consumers took over 50 per cent of the total sales in the preceding financial year.

Lincolnshire Blizzard

Widespread disorganization of electricity supplies occurred in Lincolnshire during the blizzard on 9th and 10th January. Ice loading on some of the overhead lines was as much as 5in in the early part of the blizzard and the accompanying photographs received from the East Midlands Electricity Board give an indication of the severity of the damage.

Ontario Plant Extensions

Faced with a steadily rising demand for power, the Ontario Hydro-Electric Power Commission has announced extensions costing $44·8 million at its Toronto and Niagara Falls plants. The chairman, Mr. Richard L. Hearn, said that the demand increased by 14 per cent in 1955 over 1954, a rise of more than double the average long-term rate of growth. This increase reflected the unabated growth in Ontario of all fields of activity. Two additional 75,000 kW units were to be installed at the Sir Adam Beck No. 2 generating station at Niagara and a 200,000 kW unit at the Richard L. Hearn steam station, Toronto. The two sets at the Sir Adam Beck station were originally scheduled for 1960 but they are now to be ready in time to meet the 1957 peak demand. Work on the extensions to the Toronto plant, estimated to cost $32 million, was expected to start next summer, the chairman said.

Stamp Machines in Service Centres

As a further service under its half-crown easy payment stamp scheme the North Western Electricity Board is fitting stamp machines experimentally in nine of its Service Centres. Those chosen for the experiment are at Barrow, Blackburn, Blackpool, Bolton, Bury, Oldham, Preston, Stockport and one yet to be decided upon in the Manchester area. Under the scheme half-crown stamps are bought and used in payment of accounts or for the purchase of appliances at any time. Since the scheme was introduced in 1952 over four million stamps have been sold in the North West.

A consumer obtaining a 2s 6d stamp from a machine in the Bolton Service Centre

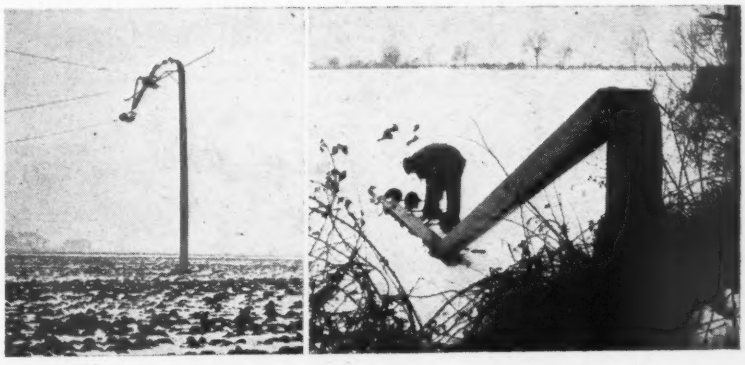
New Y.E.B. Service Centre

The Yorkshire Electricity Board's new Service Centre at Carlton Street, Castleford, was officially opened on 18th January by the Mayor of Castleford, who was accompanied by the Mayoress. Those present included Mr. D. Bellamy, chairman of the Board, together with some of the part-time members and senior officers, officials of the Corporation, representatives of the Consultative Council, the Electrical Association for Women, the National Farmers' Union, electrical contractors and appropriate local bodies. Mr. Bellamy stated that the enlarged accommodation was necessary on account of the growth which had taken place in the district, the number of consumers having increased from 23,605 at vesting day to 48,166; sales of electricity had increased from about 60 million to about 150 million kWh per annum. The number of accounts paid at the Centre has increased from about 13,000 to about 60,000 per annum.

Street Lighting at Southport

Southport Lighting Committee reports the receipt from the Ministry of Housing and Local Government of consent to borrow £35,310 for improved street lighting under Schemes 10 and 11.

Damaged pole, Boston–Skegness 33 kV line, and (right) a collapsed pole on an 11 kV line at Stickford



NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 7th March from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1947

764. Girling, F. E. J.—Radiolocation systems. 9th February, 1948. (746,170.)

1950

7783. Barrow, J. E.—Pulse delaying circuits in digital calculating machines. 28th March, 1951. (745,891.)

1951

7006. Electric & Musical Industries, Ltd. —Electron multipliers. 17th March, 1952. (745,811.)

11546. Standard Telephones & Cables, Ltd.—Totalisator equipment. 16th May, 1952. (745,812.)

14242. Brennan, J. B.—Electrically conductive elements. 15th June, 1951. (745,892.)

17481. Wilson, A.—A.c. electric motors. 24th October, 1952. (745,894.)

17761. British Thomson-Houston Co., Ltd.—Protection means for voltage control devices. 29th May, 1952. (745,895.)

27929. Edison Swan Electric Co., Ltd.—Luminescent screens. 28th November, 1951. (745,814.)

28885. Air Reduction Co., Inc.—Gas shielded electric arc welding method. 10th December, 1951. (746,023.)

29872. British Thomson-Houston Co., Ltd.,—D.c. or voltage amplifiers. 16th December, 1952. (746,024.)

1952

15734. Schüler, E.—Circuit for the ignition of fluorescent lamps. 23rd June, 1952. (745,899.)

25744. General Electric Co., Ltd., and Donelan, J. A.—Welding apparatus. 5th October, 1953. (745,824.)

27727. British Tabulating Machine Co., Ltd.—Electronic apparatus for translating a number from a first to a second radix of notation. 2nd October, 1953. (745,907.)

28125. General Electric Co., Ltd.—Apparatus for phase modulating electric oscillations. 9th November, 1953. (745,908.)

29720. General Electric Co., Ltd., Breadner, R. L., Neill, T. R. and Simms, C. H.—Manufacture of electrical devices having gas-filled sealed envelopes. 17th November, 1953. (745,910.)

29790. Philips Electrical Industries, Ltd. —Devices of the kind comprising one or more magnetic bodies. 25th November, 1952. (745,911.)

29792. Philips Electrical Industries, Ltd. —Rotary electrical apparatus in which a permanent magnet is included in the magnetic circuit. 25th November, 1952. (745,826.)

30007. Electric & Musical Industries, Ltd.—Electrically conducting cements. 27th November, 1953. (745,827.)

30706. Atkins, B. R., and Maer, P. S.—Current collecting brushes. 2nd December, 1953. (745,828.)

31269. Imperial Chemical Industries, Ltd., and Taylor, E. A.—Arc Welding of copper base alloys containing nickel. 2nd December, 1953. (745,829.)

1953

2196. Pye, Ltd.—Method of and apparatus for the distribution of television signals. 26th January, 1954. (746,031.)

4403. Henniker, R. C.—Contact devices for adjustable inductors. 15th February, 1954. (746,032.)

4674. Pye, Ltd.—Circuit arrangement for controlling the frequency of an oscillator. 18th February, 1954. (745,831.)

6833. Philco Corporation.—Stabilized deflection-amplifier system for a television receiver. 12th March, 1953. (745,832.)

10473. Marconi's Wireless Telegraph Co., Ltd.—Radar systems. 17th March, 1954. (745,925.)

11831. British Thomson-Houston Co., Ltd.—Motion pictures. 23rd April, 1954. (745,836.)

13614. Telefunken Ges. — Circuit arrangements for varying the amplitude of sawtooth currents. 15th May, 1953. (745,838.)

14016. Standard Telephones & Cables, Ltd.—Electric-discharge tubes. 19th May, 1953. (745,931.)

15968. Babcock & Wilcox, Ltd.—Forked tube fittings and the manufacture thereof. 10th June, 1953. (746,052.)

16583. Crompton Parkinson, Ltd.—Fittings for fluorescent electric lighting tubes. 6th July, 1954. (746,053.)

17009. Philips Electrical Industries, Ltd. —Magnetic and dielectric modulator circuits. 19th June, 1953. (745,940.)

17800. Mullard Radio Valve Co., Ltd.—Thyratron invertors. 19th January, 1954. (745,840.)

20657. Metropolitan-Vickers Electrical Co., Ltd.—Protective arrangements for electric motor control systems. 1st July, 1954. (745,845.)

22276. Marconi's Wireless Telegraph Co., Ltd.—Wide band grid modulated thermionic valve amplifiers. 21st June, 1954. (745,947.)

22616. General Electric Co.—Production of luminescent materials. 17th August, 1953. (746,060.)

25725. Patent-Treuhand-Ges für Elektrische Glühlampen Ges.—Luminescent material, particularly for electric-discharge lamps and method for its manufacture. 17th September, 1953. (746,065.)

27122. Philips Electrical Industries, Ltd. —Methods of providing silver layers. 2nd October, 1953. (745,857.)

27971. General Electric Co., Ltd., and Godfrey, B. J. F.—Electrical impulse generating circuits. 12th October, 1954. (746,069.)

28372. British Insulated Callender's Cables, Ltd.—Electric fuses and fuse carriers therefor. 13th October, 1954. (745,859.)

28840. Thorn Electrical Industries, Ltd. —Electroluminescent materials. 18th October, 1954. (745,860.)

29329. Licentia Patent-Verwaltungs-Ges. —Electromagnetically operated switch, particularly a contactor. 23rd October, 1953. (745,952.)

29653. Telefunken Ges.—Electron-discharge devices. 27th October, 1953. (745,953.)

32584. De Havilland Propellers, Ltd.—Synchronization of similar three-phase a.c. supplies. 18th February, 1955. (746,080.)

35659. Brentford Transformers, Ltd.—Heat pumps. 7th December, 1954. (745,870.)

36217. Erie Resistor Corporation.—Method of preparing barium titanate ceramics with flattened temperature characteristics. 30th December, 1953. (745,961.)

1954

253. Westinghouse Electric International Co.—Protective control systems for a.c. generators. 5th January, 1954. (745,964.)

984. Babcock & Wilcox, Ltd.—Cyclone furnaces. 13th January, 1954. (746,088.)

1019. Schlumberger Well Surveying Corporation.—Analysis of substances by measurement of nuclear magnetic relaxation times. 13th January, 1954. (745,873.)

1027. Akt.-Ges. Brown, Boveri & Cie.—Strand inductor for heating large workpieces inductively. 13th January, 1954. (745,874.)

1241. Compagnie Industrielle des Téléphones.—Binary numeration pulse counter. 15th January, 1954. (746,092.)

1630. General Electrical Co.—Cooling of dynamo-electric machines and other electrical apparatus. 19th January, 1954. (745,976.)

1672. Babcock & Wilcox, Ltd.—Fluent fuel-burners. 20th January, 1954. (746,097.)

2675. Telefunken Ges. — Wide-band amplifiers having a step-shaped frequency response curve. 28th January, 1954. (746,109.)

2902. Bondon, L. A.—Low capacity co-axial electric cable. 1st February, 1954. (746,111.)

3239. Soc. Alsacienne de Constructions Mécaniques.—Electric pulse code transmission devices. 3rd February, 1954. (745,979.)

3292. Ateliers de Construction Eléctriques de Charleroi.—Machine for sticking parts together by high-frequency heating of adhesive. 4th February, 1954. (746,113.)

4027. Indevco, Inc.—Process and apparatus for heating water by electrical conduction. 11th February, 1954. (745,983.)

4086. Hoover, Ltd.—Power-driven tools. 11th February, 1954. (746,121.)

4890. General Motors Corporation.—Electrical systems for automatically dimming automobile headlamps. 19th February, 1954. (746,126.)

5936. Kockums Jernverks Aktiebolag.—Pin connected tubular electric heater. 1st March, 1954. (745,988.)

6076. Western Electric Co., Inc.—Pulse counting circuit arrangements. 2nd March, 1954. (746,131.)

9771. Hellermann, Ltd.—Plug and socket connector for electric conductors. 2nd April, 1954. (746,000.)

10270. Poludniak, W. B.—Lock controlled alarm switch for preventing unauthorized use of motor vehicles. 7th April, 1954. (746,141.)

11169. General Electric Co.—Dynamo-electric machines. 15th April, 1954. (746,002.)

12014. British Thomson-Houston Co., Ltd.—Cooling of dynamo-electric machines. 26th April, 1954. (746,005.)

15361. Flader, Inc., F.—Insulated aerial fittings. 25th May, 1954. (746,144.)

19353. General Electric Co.—Dynamo-electric machines and the ventilation thereof. 1st July, 1954. (746,014.)

21420. Hazeltine Corporation.—Radio position locator. 22nd July, 1954. (746,151.)

25650. General Electric Co.—Supporting of coil end turns in stators and rotors of dynamo-electric machines. 3rd September, 1954. (746,157.)

27242. Sulzer Frères Soc. Anon.—Means for mounting heating surface tubes in steam generators. 21st September, 1954. (746,160.)

28071. Forges et Ateliers de Construction Eléctriques de Jeumont.—Illuminated signalling panels. 29th September, 1954. (746,165.)

28810. Fligne, W. De.—Electromagnetic devices. 6th October, 1954. (746,167.)

29082-3. General Electric Co.—Flexible electric-heating cables. 8th October, 1954. (746,018-746,017.)

29772. Metropolitan-Vickers Electrical Co., Ltd.—Cooling of electric machines. 15th October, 1954. (746,168.)

32858. Philips Electrical Industries, Ltd. —Anisotropic, permanent magnetic cylindrical members. 12th November, 1954. (746,019.)

NEXT WEEK'S EVENTS

Organizers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

Monday, 6th February

BIRMINGHAM.—James Watt Institute, 6 p.m. I.E.E. South Midland Centre. Three short papers. (Joint meeting with the Graduates' & Students' Section.)

CHESTER.—Town Hall, 6.30 p.m. I.E.E. Mersey & North Wales Centre. "A High-Power Mechanical Contact Rectifier," by Dr. J. C. Read and C. F. Gimson.

DUBLIN.—Gresham Hotel. I.E.E. Irish Branch. Annual dance.

HALIFAX.—White Swan Hotel, 7.15 p.m. Institution of Production Engineers, East & West Ridings Region, Halifax Section. "Computer Controlled Machine Tools," by H. Ogden.

ILFORD.—Angel Hotel, 8 p.m. A.S.E.E. North-East London Branch. "Thermoplastic Cables," by F. J. Smith.

LEEDS.—Great Northern Hotel, 7.30 p.m. A.S.E.E. Leeds Branch. "Space Heating."

LONDON.—Savoy Place, W.C.2., 5.30 p.m. Institution of Electrical Engineers, informal meeting. Discussion on "What should be our National Fuel Policy," opened by E. F. Schumacher.

Caxton Hall, S.W.1., 7 p.m. E.P.E.A., London Technical Group. "Development of Airbreak Switchgear," by F. S. Fay and D. Legg.

Burlington House, W., 5.30 p.m. Society of Engineers. Presidential address, by Capt. H. F. Jackson.

NEWCASTLE-UPON-TYNE. — King's College, 6.15 p.m. I.E.E. North-Eastern Radio & Measurement Group. Informal lecture on "A Simple Introduction to Telegraph Codes," by H. V. Higgitt.

County Hotel, Neville Street, 6 for 6.30 p.m. North East Electrical Club. "Alkaline Storage Batteries," by R. W. Allen.

SHEFFIELD.—Royal Victoria Station Hotel, 7.30 p.m. A.S.E.E. Sheffield Branch. "Gas Filled Cables."

Monday, 6th February, to Thursday, 9th February

GLASGOW.—Kelvin Hall. Electronics & Productivity Conference and Exhibition. (Organized by the South of Scotland Electricity Board.)

Tuesday, 7th February

CARDIFF.—Angel Hotel, 7.30 p.m. A.S.E.E. South Wales Branch. "Safety Regulations."

EDINBURGH.—11, Atholl Crescent, 7.30 p.m. Edinburgh Electrical Society. "A Visit to Russia on a Trade Mission," by J. B. Scott.

ELTHAM. — Congregational Church Hall, Court Road, 8 p.m. A.S.E.E. South-East London Branch. "Stage Lighting."

HAMMERSMITH.—Windsor Castle Hotel, 134, King Street, 7.30 p.m. A.S.E.E. West London Branch. "Electrostatic Precipitation," by S. Laurie-Walker.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Centre. "Measurement as a Factor in Understanding," by Dr. K. J. R. Wilkinson.

LONDON.—Savoy Place, W.C.2., 6.30 p.m. I.E.E. London Graduates' & Students' Section. "A Survey of the Various Types of Tachogenerators suitable for Control Applications," by L. J. Jones.

At the Royal Society of Arts, John Adam Street, 7 p.m. Incorporated Plant Engineers, London Branch. "Electronics in Industry," by J. E. Fielden.

LOUGHBOROUGH.—The College, 6.30 p.m. I.E.E. East Midland Centre. "The Generation and Synthesis of Music by Electrical Means," by A. Douglas.

MANCHESTER. — Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Centre. "Germanium and Silicon Power Rectifiers," by T. H. Kinman, G. A. Carrick, R. G. Hibberd and A. J. Blundell.

PETERBOROUGH.—White Lion Hotel, Church Street, 7.30 p.m. Institution of Production Engineers, North Midlands Region, Peterborough Section. "The Use of Electronics in Engineering," by J. A. Stokes and N. B. Milne. (Joint meeting with the Incorporated Plant Engineers, Peterborough Section.)

READING. — University Letters Lecture Theatre, London Road, 7 p.m. A.S.E.E. Oxford, Reading & Districts Branch. "The Industrial Use of Magnetic Power," by T. Hawker.

Tuesday, 7th February, to Thursday, 9th February

BOURNEMOUTH.—National Power Farming Conference.

Wednesday, 8th February

ABERDEEN.—Caledonian Hotel, 7.30 p.m. I.E.E. North Scotland Sub-Centre. Film evening.

BIRMINGHAM. — Chamber of Commerce, New Street, 7.15 p.m. A.S.E.E. Birmingham Branch. Lecture on switchgear.

BURTON-ON-TRENT. — Electricity Service Centre, 6.30 p.m. I.E.E. North Staffordshire Sub-Centre. "The Supply of Electricity in the London Area," by D. B. Irving.

DUNDEE.—New Imperial Hotel, 15, Tally Street, 7.30 p.m. Institution of Production Engineers, Scottish Region, Scotland Section. "Electronic Control of Machine Tools," by E. Heys.

FARNBOROUGH.—R.A.E. Technical College, 7.30 p.m. I.E.E. Southern Centre. "V.h.f. Propagation by Ionospheric Scattering and its Application to Long-Distance Communication," by W. J. Bray, Dr. J. A. Saxton, R. W. White and G. W. Luscombe.

HALIFAX.—Crown Hotel, Horton Street, 7.30 p.m. A.S.E.E. Halifax Branch. "Industrial and Commercial Lighting," by J. W. Howell.

LANCASTER. — N.W.E.B. Demonstration Theatre, North Road, 7.15 p.m. I.E.E. North Lancashire Sub-Centre. "The Standardization of Retail Electricity Tariffs," by A. O. Johnson and N. F. Marsh.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Radio & Telecommunication Section. "Pulse Techniques, with particular reference to Line and Radio Communication," by Dr. Ing. E. M. Deloraine.

Savoy Hotel, W.C.2, 6.45 for 7.30 p.m. The Institution of Heating and Ventilating Engineers. Annual dinner.

Savoy Hotel, 12.30 for 1 p.m. Gauge & Tool Makers' Association. Trade luncheon. Speaker, Mr. Peter Thorneycroft, M.P.

At the Royal Society of Arts, John Adam Street, W.C.2, 6.45 p.m. Institution of Engineering Inspection. "Isotopes in Industry," by J. C. Rockley.

MANCHESTER. — Engineers' Club, Albert Square, 2.30 p.m. Institute of Fuel, North-Western Section. "Some Recent Advances in Fuel Research," by Dr. W. Idris Jones. (Joint meeting with the North-Western Division of the National Smoke Abatement Society.) Preceded by luncheon (1 p.m.).

NORTHAMPTON.—I.E.E. Rugby Graduates' & Students' Section, district meeting. "Electrical Contracting," by D. Pitts.

OXFORD.—37, George Street, 7 p.m. I.E.E. district meeting. Discussion on "Developments in the Wiring of Buildings."

RUGBY.—Church House, 7 p.m. Institution of Production Engineers, Midlands Region, Coventry Section. "The Effect of Operative Conditions on Designing and Constructing of Diesel Electric Locomotives," by G. G. Kibblewhite.

SHEFFIELD.—The University, St. George's Square, 7 p.m. Society of Instrument Technology, South Yorkshire Section. "Ad Hoc Instrumentation," by W. C. Heselwood.

WIMBLEDON.—32, Worple Road, 8.15 p.m. A.S.E.E. South-West London Branch. "Specialized Spot Welding," by C. G. Aldridge.

WOLVERHAMPTON. — Wolverhampton & Staffordshire Technical College, Wulfruna Street, 7.15 p.m. British Institution of Radio Engineers, West Midlands Section. "The Ionophone Loudspeaker," by A. E. Falkus.

YORK.—"The Shambles Café," 7.15 p.m. A.S.E.E. York Branch. "Earth Fault Protection," by F. Grant.

Thursday, 9th February

DUNDEE.—Queen's College, 7 p.m. I.E.E. North Scotland Sub-Centre. Film evening.

LEICESTER.—Windsor Room, Bell Hotel, 7 p.m. Institution of Production Engineers, North Midlands Region, Leicester Section. Annual general meeting, followed by film, "Induction Heating."

LONDON.—Manson House, Portland Place, 6.30 for 7 p.m. Society of Instrument Technology, Control Section. Annual general meeting, followed by "The Scope for Feedback Control and Automatic Calculation in Industrial Mechanization," by Prof. A. Tustin.

Waldorf Hotel, Aldwych, 6.45 for 7 p.m. Institution of Works Managers, London Branch. "Electronics and Control Engineering."

2, Savoy Hill, W.C.2, 6 for 6.30 p.m. Institute of Welding, South London Branch. "Welding Metallurgy and Electrode Development," by J. Mercer.

At the Royal Institution, Albemarle Street. Institution of Production Engineers. Sir Alfred Herbert paper, "Work Design and Training for Future Industrial Skills," by Dr. N. H. Mackworth. (Tea 5.30 p.m.)

MIDDLESBROUGH.—Cleveland Scientific & Technical Institution, Corporation Road, 7.30 p.m. Society of Instrument Technology, Tees-Side Section. "Pneumatic Circuits for Transmission and Control," by H. Williamson.

NEW BRIGHTON.—Hotel Victoria. Incorporated Plant Engineers, Merseyside & North Wales Branch. Dinner and dance.

SOUTHAMPTON.—Polygon Hotel, 8 p.m. A.S.E.E. Southampton Branch. Technical films.

SWANSEA. — S. Wales Electricity Board Showrooms, The Kingsway, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. Short papers by P. Williams, R. F. Doel and G. E. Evans.

Friday, 10th February

BIRMINGHAM. — Imperial Hotel. Incorporated Plant Engineers, Birmingham Branch. Annual dinner.

LIVERPOOL.—Adelphi Hotel. Institution of Works Managers, Merseyside Branch. Dinner party dance.

LONDON.—Savoy Place, W.C.2., 6.30 p.m. I.E.E. London Graduates' & Students' Section. Conversazione and dance.

Caxton Hall, S.W.1., 6.30 p.m. E.P.E.A., Southern Meter Engineers' Group. "Transformer Loss Metering," by H. Jackson.

Pepys House, 14, Rochester Row, 7 p.m. Junior Institution of Engineers. "A Production Control System Incorporating an Electronic Computer," by W. J. Kease.

NOTTINGHAM.—Odeon Restaurant and Ballroom, Angel Row. A.S.E.E. Nottingham Branch. Annual dinner and dance.

"Black Boy," 6.30 for 7 p.m. Institute of Fuel, East Midland Section. Annual dinner.

SHEFFIELD.—Grand Hotel, 7 for 7.30 p.m. Institute of Metal Finishing, Sheffield & North-East Branch. Dinner and dance.

STOKE.—North Stafford Hotel, 8 p.m. A.S.E.E. Stoke & Crewe Branch. "Power System Protection," by F. E. Wellman.

STONE.—Duncan Hall, 7 p.m. I.E.E. North Staffordshire Sub-Centre. "Colour Television," by L. C. Jesty.

SWANSEA. — Central Library, Alexandra Road, 7.30 p.m. Institution of Production Engineers, Welsh Region, West Wales Section. "Automation for Production," by F. Garner.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—15th March. Posts and Telegraphs, G.P.O., Melbourne. Substation accessories. (E.S.B. 1317/56. Ten/17572.)*

Belgian Congo.—28th February. Government General, Leopoldville. Electrical installation at Coquilhatville Airport. (E.S.B. 997/56. Ten/17600.)*

Cork.—8th February. County Council. Laundry equipment for Fermoy Hospital. (E.S.B. 1737/56. Ten/17613.)*

High Wycombe.—20th February. Borough Council. Street lighting equipment. (See this issue.)

India.—14th February. India Supply Mission, Washington. 19 f.h.p. motors. (E.S.B. 1406/56(ICA). Ten/17607.)* 15th March. Government of Saurashtra, Central Stores Purchase Organisation, Rajkot. Two 5,000 kW generating sets. (E.S.B. 1077/56. Ten/17549.)*

22nd February. Director-General of Supplies and Disposals. Electric furnace. (E.S.B. 1759/56. Ten/17624.)*

Iraq.—13th March. Mosul Municipality. 500 fluorescent mercury vapour lanterns for street lighting. (E.S.B. 1408/56. Ten/17599.)*

London.—9th February. Metropolitan Water Board. Supply of electric lamps and fluorescent tubes (contract No. 24), for the year ending 31st March, 1957. Chief engineer, Offices of the Board, New River Head, Rosebery Avenue, London, E.C.1.

Pakistan.—20th February. Government Department of Supply and Development. Diesel electric crane, and fork-lift truck with trailers. (E.S.B. 1861/56. Ten/17621.)*

Philippines.—16th February. Office of the National Power Corporation, Manila. Transmission line conductors. (E.S.B. 2259/56. Ten/17661)*

Rowley Regis.—6th February. Borough Council. Supply of electricians' requisites for the year ending 31st March, 1957. John Hilton, town clerk, Municipal Buildings, Old Hill, Staffs.

St. Albans.—15th February. City Council. Street lighting equipment. (See this issue.)

Salford.—14th February. City Corporation. Supply of conduit and fittings, etc., during the period 1st April, 1956 to 31st March, 1957. 3rd March. Street lighting equipment. (See this issue.)

South Africa.—15th February. Stores Dept., South African Railways. 100 kVA outdoor type transformer. (E.S.B. 1018/56. Ten/17562.)* 16th February. Union Tender and Supplies Board. Indicators, resistance and switchboard lamps. (E.S.B. 1350/56. Ten/17586.)* Dial mountings and plugs for telephone switchboards. (E.S.B. 1444/56. Ten/17592.)* Carbon electrode protectors. (E.S.B. 1404/56. Ten/17575.)* 17th February. Track section switches. (E.S.B. 1768/56. Ten/17641)*

Uruguay.—28th February. Administracion General de la Usinas Electricas y los Telefonos del Estado. Pressure clamps for telephone cables. (E.S.B. 484/56. Ten/17551.)* 21st March. 100,000 circuit-breakers. (E.S.B. 1012/56. Ten/17522.)*

Walsall.—10th February. Borough Welfare Committee. Supply of electric lamps for the year ending 31st March, 1957. R. E. Goakes, chief welfare officer, Welfare Dept., 29, Leicester Street.

Westhoughton.—6th February. U.D.C. Supply of electric lamps for the year ending 31st March, 1957. F. H. Walker, surveyor, Town Hall.

Wokingham.—13th February. R.D.C. Two electrically-operated vertical spindle pumps, complete with motors, starters, control gear, etc., for Wargrave Sewerage reconstruction. Chief engineer, Council Offices, Shute End, Wokingham.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Bournemouth.—Corporation Highways and Works Committee. Recommended. Four electric street cleansing trucks (£1,556).—Harborough Construction Co. Supply and erection of 411 lighting units in connection with main road lighting proposals (£17,584).—Revo Electric Co.

Dagenham.—Highways and Works Committee. Recommended. Stage 4 of street lighting conversion scheme (£38,151).—Harland & Wolff.

Gosport.—Corporation. Recommended. Installation of 80 W mercury vapour street lighting in Privett Road, and on the route via Portsmouth Road, Marine Parade East to Lee Tower (£8,435).—Southern Electricity Board.

Shrewsbury.—Birmingham Regional Hospital Board. Recommended. Rewiring the electrical and telephone installation at the Shelton Hospital, Shrewsbury (£11,990).—T. Wood & Son (Chester), Ltd.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ayr.—Reconstruction of Gaiety Theatre; Popplewell & Sons, Pavilion Ballroom.

Banbury.—Lecture room, laboratory and agricultural machinery shops at North Oxon. Technical College and School of Art, Bath Road; county architect, County Hall, Oxford.

Belfast.—Factory extensions; Short Bros. & Harland, Ltd., 17, Grosvenor Street, London, W.1.

Factory; R. & W. A. C. McCandless, Limestone Road.

Cantley.—Infants' school and junior school, to be named the Sycamore Schools (£83,000 together); borough architect.

Cheltenham.—Shopping centre, Edinburgh Place; Hesters Way estate; Ravenseft Properties, Ltd., 52, Charles Street, London, W.1.

Houses (40), Shurdington; Western Estates, Ltd., Norwood Road.

Out-patients' department, General Hospital; South Western Regional Hospital Board, Tyndalls Park Road, Bristol.

Darlington.—Police station and headquarters, Bridge Street; county architect, Durham.

Dewsbury.—Hostels on sites at Chickenley and Dewsbury Moor (£62,000); borough surveyor, Municipal Buildings, Halifax Road.

Donaghadee.—Factory and offices; Cyril Lord, Ltd., 7, Wellington Place, Belfast.

Eccles.—Administrative building at Silk Street for Shell Mex, Ltd.; N. J. Skeet, architect, Handforth Road, Wilmslow.

Gateshead.—Shopping centre, Beacon Lough; G. F. Winters, borough engineer.

Gillingham (Kent).—Houses (43), Brompton redevelopment area; Frank Hill, town clerk, Municipal Buildings.

Hanwell.—Factory extensions, Southall Trading Estate; Hygrade Corrugated Cases, Ltd., Boston Road, Hanwell, W.7.

Hemel Hempstead.—Factory and offices; T. Foxall & Sons, 154, Drummond Street, London, N.W.1.

Kidderminster.—Three-storey building at Oxford Street, Marlborough Street and Worcester Street, for Max Rayne; C. H. Elsom, architect, 44, Catherine Place, London S.W.1.

Leeds.—Health centre; city architect, Priestley House, Quarry Hill, Leeds.

London.—Office block, Paul Street; A. E. Symes, Ltd., builders, Carpenters Road, E.15.

Flats (58), Victoria Grove, Finchley; borough engineer.

Bus garage, West Green Road, Tottenham; London Transport Executive, 55, Broadway, S.W.1.

R.C. church, Winchester Street, Westminster; Foster & Dicksee, Ltd., builders, 1, Baker Street, W.1.

Out-patients' department at the Royal Northern Hospital, Holloway; (£250,000), for North East Metropolitan Regional Hospital Board; regional architect, 3, Queen Anne Street, W.1.

Manchester.—Combined maternity, child welfare, school medical and dental clinics at Blackley and Charlestown; L. C. Howitt, city architect, Town Hall.

Newcastle-on-Tyne.—Flats and maisonnettes (56), Kenton North estate; city architect, 18, Cloth Market.

School with swimming bath, Grange Road; city architect.

Twelve-storey parking garage to accommodate 600 cars; J. Hogg, Fox and Hounds Garage, Newcastle.

Nottingham.—Conversion of Clifton Hall into grammar school (new block, hall, science laboratories, etc., £123,000); R. M. Finch, city surveyor, Guildhall.

Out-patients' department for City Hospital; Sheffield Regional Hospital Board, Fulwood House, Sheffield, 10.

Rotherham.—Old persons' home on the Herringthorpe Valley estate (£40,000); E. J. Manson, borough surveyor, Municipal Offices.

Extensions to Technical College; Roger Preston & Partners, consulting engineers, 15, North Audley Street, London, W.1.

Seaham.—Houses (218); A. M. Smith, U.D.C. surveyor.

Sheffield.—Jordanthorpe Secondary School for Girls; Edward A. Pearce & Partners, consulting engineers, 28, Baker Street, London, W.1.

Stalybridge.—Stores and offices at Castle Works, for Aerialite, Ltd.; W. George (Builders), Ltd., 3, Mellor Street, Droylesden.

Stamford.—Houses (42); F. J. Lenton & Partners, architects, Broad Street.

Tynemouth.—Secondary modern school at Billy Mill Lane, North Shields, and additions to the Open-Air School at The Chase; borough engineer, 16, Northumberland Square, North Shields.

R.C. school, church and presbytery at Marden; R. Burke, architect, Lambton House, Lambton Road, Newcastle-on-Tyne.

Blocks of flats (54 dwellings) at North Shields (£139,000); Leslie and Co., builders, Woodland Road, Darlington.

Wednesbury.—Factory, Portway Road; Stanley Horne & Sons, Ltd., engineers and machinists, Foster Street, Darlaston.

West Bromwich.—Reconstruction of public baths; Hoare, Lea & Partners, consulting engineers, 23, St. James Road, Edgbaston, Birmingham.

West Hartlepool.—Houses (80) and flats (20); A. G. Sinclair, borough architect.

Houses (102), Kingsley Avenue; C. M. Yuill, Ltd., builders, Villiers Street.